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# ENVIRONMENTAL SURVEYS OF THE URANIUM MILL TAILINGS PILE AND SURROUNDING AREAS, SALT LAKE CITY, UTAH

David L. Duncan, et al

Office of Radiation Programs
Las Vegas, Nevada

August 1974

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Environmental surveys were conducted for the Utah State Division of Health's Occupational and Radiological Health Section at the former Vitro Corporation uranium mill and the Salt Lake City, Utah area. The results of the surveys indicated that: the external radiation levels on the tailings area exceed recommended exposure limits for individuals in the general population; ambient levels of radon over the pile and in structures built immediately adjacent to the tailings pile are above the currently recommended concentration for the general population; the working level exposure in the adjacent buildings exceed existing recommendations; tailings material has been removed from the site and used around dwellings and businesses; and tailings material has become windborne and deposited against dwellings and structures in the vicinity. For general public areas (at distances greater than one-half mile from the tailings pile) the measured radon levels for the pile were not distinguishable from natural background levels and were found to be within current guides.

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AUGUST 1974

URANIUM MINING AND MILL TAILINGS PROJECT
OFFICE OF RADIATION PROGRAMS--LAS VEGAS FACILITY
U.S. ENVIRONMENTAL PROTECTION AGENCY
LAS VEGAS, NEVADA

# FOREWORD

The Office of Radiation Programs of the Environmental Protection Agency carries out a national program designed to evaluate population exposure to ionizing and non-ionizing radiation, and to promote development of controls necessary to protect the public health and safety.

Within the Office of Radiation Programs, the Las Vegas Facility conducts in-depth field studies of various radiation sources (e.g., nuclear facilities, uranium mill tailings, and phosphate mills) to provide technical data for environmental impact statement review as well as needed information on source characteristics, environmental transport, critical pathways for population exposure, and dose model validation.

This report summarizes the results of several field studies conducted between 1967 and 1973 in Salt Lake City, Utah, at and around the inactive uranium mill tailings site formerly operated by the Vitro Corporation of America.

Readers of this report are encouraged to inform the Office of Radiation Programs of any omissions or errors. Comments or requests for further information are also invited.

W. D. Rowe, Ph.D.
*Deputy Assistant Administrator*
*for Radiation Programs*

# ABSTRACT

At the request of EPA's Region VIII, environmental surveys have been conducted for the Utah State Division of Health's Occupational and Radiological Health Section at the former Vitro Corporation uranium mill and in the Salt Lake City, Utah, area. The surveys included measurement of external gamma radiation and airborne radioactivity. The results of the surveys indicated that: the external gamma radiation levels on the tailings area exceed recommended exposure limits for individuals in the general population; ambient levels of radon over the pile and in structures built immediately adjacent to the tailings pile are above the currently recommended concentration for the general population; the working level exposure in the adjacent buildings exceeds existing recommendations; tailings material has been removed from the Vitro site by persons and used around dwellings and businesses; and tailings material has become windborne and deposited against dwellings and structures in the vicinity. For general public areas (at distances greater than one-half mile from the tailings pile) the measured radon levels for the pile were not distinguishable from natural background levels and were found to be within current guides.

On June 7, 1974, the U.S. Environmental Protection Agency recommended to the State of Utah that:

1. The State of Utah establish the necessary regulations to effect the disposition and control of radioactive mill tailings. These should not rule out the possibility of some acceptable use for any given closed mill site.

2. The Vitro uranium mill tailings pile should be properly stabilized to prevent migration of the tailings into the environment and public ingress to the area should also be prevented. The pile should be graded,, covered, properly fenced, and controlled to prevent any migration of the tailings into the surrounding environs by wind, water erosion, or removal of tailings for unauthorized purposes.

3. The State of Utah consider possible remedial actions for the businesses located on the west side of the Vitro uranium mill tailings pile along South 900 West Street.

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# ACKNOWLEDGMENTS

Grateful appreciation is expressed by the Environmental Protection Agency to the many individuals of the Utah State Division of Health; U.S. Atomic Energy Commission; Lucius Pitkin, Inc.; and EPA's Region VIII and National Environmental Research Center--Las Vegas. Without their help, these studies would not have been possible. Special thanks go to Messrs. Dennis Dalley, Louis Bunce, Blain Howard, Jeff Throckmorton, Paul Smith, Jon Yeagley, George Boysen, Charles Fitzsimmons, Dwayne Rozell, Robert Snelling, and Fred Johns and also to Mrs. Lynn Hughes and Ms. Daphne Prochaska.

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## PURPOSE

The following report summarizes the results of several environmental surveys conducted between 1967 and 1973 in Salt Lake City, Utah, at the inactive uranium mill site and in the surrounding area.

## LOCATION AND DESCRIPTION

The uranium mill in Salt Lake City, Utah, was operated by the Vitro Corporation of America from May 1951 to January 1964. As of July 1970, the inactive uranium mill tailings pile occupied about 107 acres of land, bordered on the north by Mill Creek, on the east by the railroad, on the south by 3300 South Street, and on the west by South 900 West Street. As shown in figure 1, the area of the mill site can be considered as a square with four quadrants. Three of the quadrants are covered with tailings material and the northeast quadrant is occupied by the Salt Lake City Suburban Sewage Treatment Plant (SSTP). A portion of the land between the railroad and the east boundary of the SSTP is also covered with tailings.

The original uranium mill was situated in the southeast section, but the buildings have now been completely demolished. All that remains of the old mill are some rubble and concrete foundations of the buildings and the old mill stack. As of May 1974, radioactive material has been spread over the old mill site and contaminated material has also been placed on what appears to be railroad right of way. It is estimated (1) that the Vitro uranium mill tailings piles contain 1,666,000 tons of material with an average radium-226 concentration of 1100 pCi per gram of tailings material (or about 1670 total curies of radium-226).

There is a narrow access road from 3300 South Street leading to the Suburban Sewage Treatment Plant and a shallow stream flows parallel to this road, thereby creating a boundary line between the southeast and the southwest sections of the tailings piles. There is no gate on this access road and it is through this open entranceway that most of the public access to the tailings piles is gained. The southern one-half of the southeast section of the tailings pile has been covered with about a foot of "clean" dirt as a result of road construction in the area.

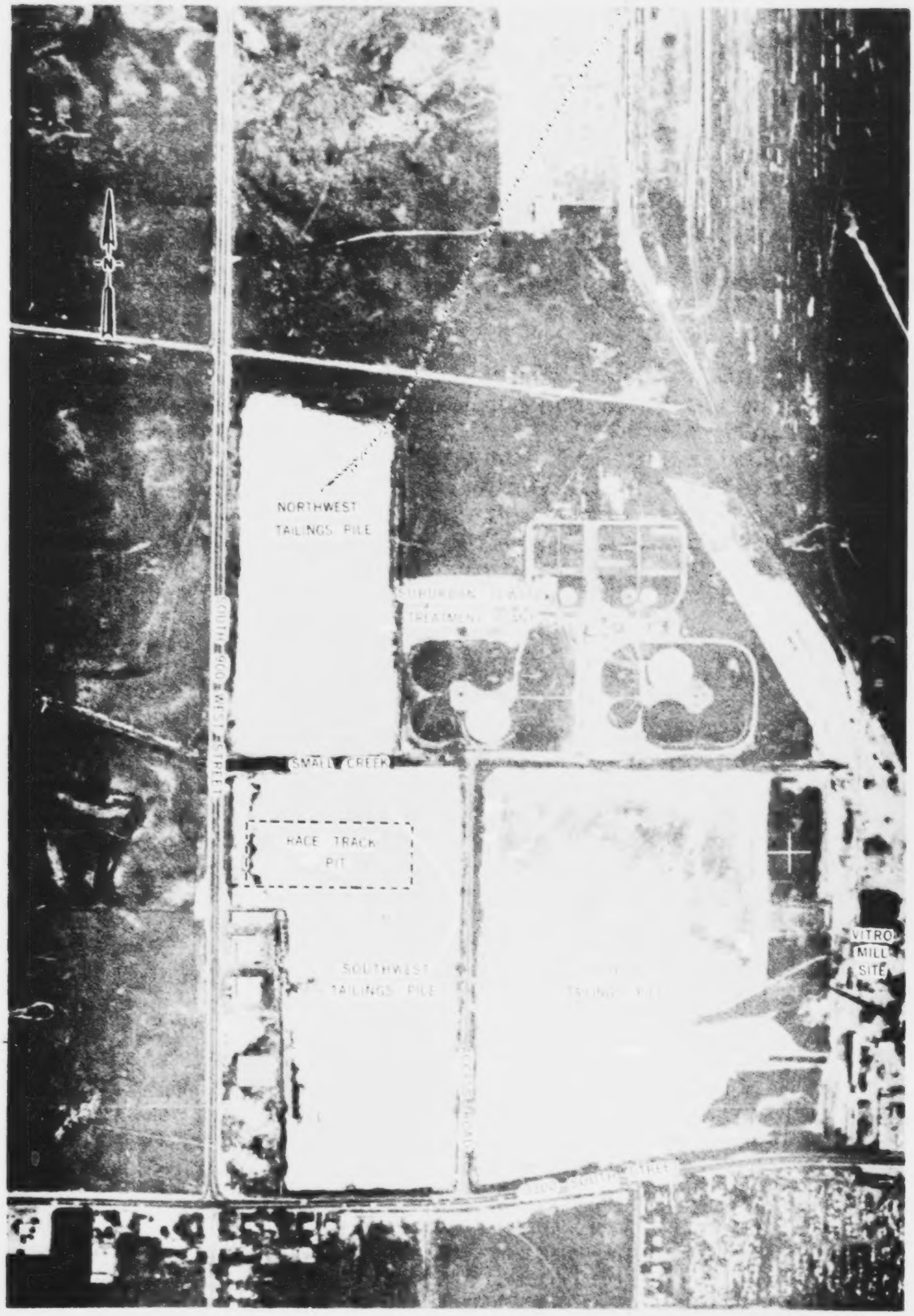

N
NORTHWEST
TAILINGS PILE
SUBURBAN
TREATMENT
SOUTH 900 WEST STREET
SMALL CREEK
RACE TRACK
PIT
SOUTHWEST
TAILINGS PILE
TAILINGS PILE
VITRO
MILL
SITE
SOUTH STREET

Figure 1. Vitro Uranium Mill Tailings Piles: Salt Lake City, Utah

The southern one-half of the southwest section of the tailings piles has been covered with concrete, dirt, and asphalt road debris. Bordering the southwest section of the pile, on South 900 West Street, are four business buildings. These structures were built against, and possibly over, the tailings pile. An eight-foot-high chain link fence has been erected on the south side of the tailings pile (i.e., along 3300 South Street) and along a portion of the east and west sides of the tailings pile. The fence ends at the northernmost building on the west side of the piles; therefore, entry to the tailings piles area may also be gained at this point. Indeed, the abandoned tailings piles have become a motorbike and horse riding course for the area youngsters.

Most of the tailings piles surface remains uncovered and, as a result, a slick, muddy surface is formed after rain or snow storms. When the pile surface dries out, the tailings materials are subject to wind migration and the materials are easily spread to offsite areas surrounding the mill site. Grass cover or volunteer vegetation growth has not occurred over the entire tailings pile surface, although some of the dikes are covered with growth. It is also apparent that at times local inhabitants have removed portions of the tailings material for various uses around their private dwellings and buildings. Trash is also being discarded at the mill site.

In 1972-1973, construction was initiated in the upper half of the southwest section of the tailings pile for a proposed automobile racing track. An oval-shaped pit about 15 feet deep, 200 feet wide, and 500 feet long was dug out of the tailings material. The west end of the pit is about 100 feet from South 900 West Street, at the fence boundary of the Won-Door Corporation Assembly Building (Location #42330). The tailings material which was removed to create the pit was piled on the original pile surface to form hills from 10 to 20 feet in height, surrounding the pit. After a rain storm, the eastern portion of the pit floor is covered with several inches of water. The pit floor is at the level of the street; i.e., the original ground level before tailings material was placed on it.

A stream formed by the effluent discharged from the Suburban Sewage Treatment Plant flows between the southwest and northwest sections of the pile. Water flow is away from the tailings pile. In November 1970, the northern one-half of the southeast section of the tailings pile was covered with water; and in May 1973, the northwest section of the pile was partially covered with water. This water was from operations at the Suburban Sewage Treatment Plant. Except for a few strands of barbed wire fence, there is no access control to the northwest section of the pile.

The Suburban Sewage Treatment Plant, which forms the northeast quadrant of the site, is entirely fenced and is a restricted access location, usually limited to SSTP operating personnel.

## ENVIRONMENTAL SURVEYS

### Sampling procedures

### External gamma radiation

#### *Field survey instruments*

Gamma radiation exposure measurements were obtained using portable radiation detection instruments. Two types of survey meters were used at different times during the studies. An Eberline Instrument Corporation, Model E-500B, portable Geiger-Mueller survey meter was used and the gamma exposure rate was reported in units of mR/h. Also used for more sensitive gamma surveys was the NE-148A Baird Atomic Scintillometer and these results were reported in units of μR/h.

#### *Thermoluminescent dosimeters (TLD's)*

In addition to the portable survey instruments, TLD's were used in two studies (1967-1968 and 1970) to evaluate the external gamma exposure dose. EG&G, Model TL-12, TLD capsules were used and returned to the laboratory* for analysis. The TLD results were reported in units of mR/h.

#### *Mobile unit gamma radiation scanning surveys*

The EPA provided a contract to the U.S. AEC to conduct a mobile gamma scanning survey in communities surrounding uranium mill tailings sites in the Western United States. These scanning surveys were performed in Salt Lake City, Utah, starting in April 1972.

---

*EPA, National Environmental Research Center--Las Vegas (NERC-LV) at Las Vegas, Nevada (formerly USPHS, Southwestern Radiological Health Laboratory).

The mobile gamma scanning unit was equipped with two shielded four-inch by five-inch sodium iodide crystals. The signal from the crystals was recorded on a strip chart recorder and addresses or other notes were added to the chart by the operator. This chart was then sent to the Lucius Pitkin* Office in Grand Junction, Colorado, where an anomaly report was prepared from the chart. An anomaly is defined as any location where the recorded counts per second (c/s) exceed the determined background c/s for that location by 50 or more c/s. The anomaly report was sent to ORP-LVF** and, in turn, forwarded to the Utah State Division of Health.

### *Field personnel gamma radiation screening surveys*

Survey teams, utilizing the gamma scanning report, performed field radiation surveys in Salt Lake City. These surveys were performed between August and October 1972.

The field teams were composed of two surveyors; each person was equipped with a NE-148A Baird Atomic Scintillometer. These instruments were calibrated with a National Bureau of Standards certified radium needle, and a five item field check was performed each day to determine if the instrument was functioning properly. If the instrument did not operate within preset ranges, it was not used.

The NE-148A contains a one-inch by one-and-one-half inch sodium iodide crystal; thus, the measurements obtained are not "true" exposure rates. Also, because of the size of the crystal, the meter indication represents only terrestrial radiation. The meter reading can be corrected to a true value (T) by T (μR/h) = S (μR/h) x 0.56 + 0.9, where S = NE-148A meter reading.

---

* Lucius Pitkin, Inc., is a prime contractor for the U.S. AEC, Grand Junction Operations Office.

**The EPA, Office of Radiation Programs, Las Vegas Facility (ORP-LVF) is a tenant organization located at the NERC-LV. The ORP-LVF now conducts the uranium mill tailings monitoring previously carried out by the NERC-LV.

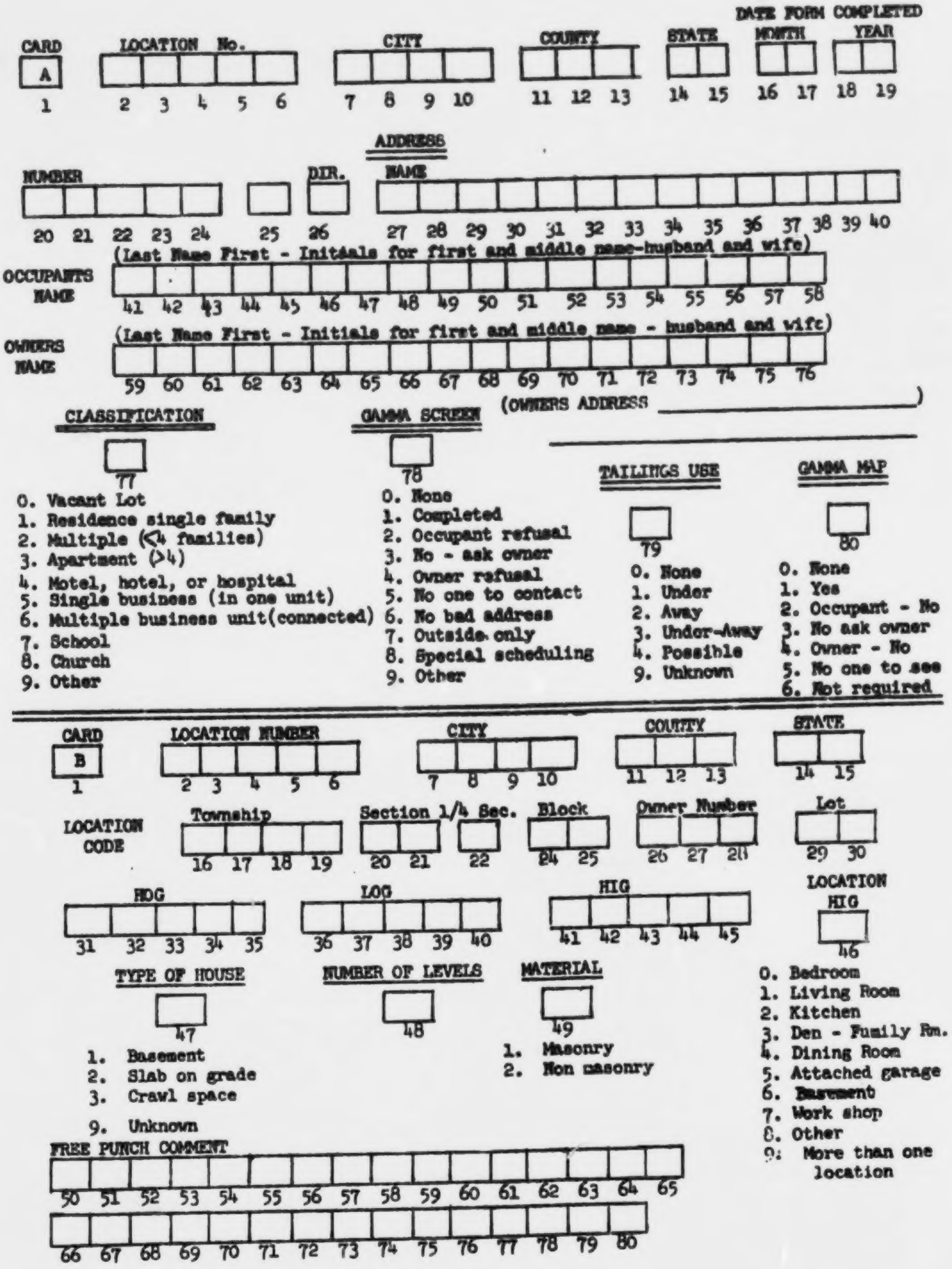
Thus, a reported 60 μR/h becomes a corrected 34.5 μR/h, or a net corrected 24.5 μR/h (assuming 10 μR/h background). One can obtain a total exposure rate by adding the corrected value, in this case, 34.5 μR/h, and a known or assumed cosmic rate. The previously mentioned TLD and E-500B readings in mR/h do not have to be corrected.

A survey was performed at a location only after permission was obtained from the owner or occupant of the property. If persons were present, but permission was not obtained, the location was listed as a refusal. Suspected tailings use might have been determined while approaching the property or structure to request permission and would be noted. Once permission to survey was obtained, one surveyor would survey inside the structures while his partner would survey the surrounding property. The high inside gamma instrument reading (HIG), high outside (HOG), and low outside (LOG) were recorded on the Indoor Radon Study-Gamma Screening Form. A copy of this form is included as figure 2. If tailings were found on the property, but more than 10 feet from a habitable structure, the location is called a tailings away or TA location. The tailings use code would be "2." If tailings were found within 10 feet of a habitable structure, it is a TU location (under or up against). In this case, the tailings use code would be "1" or "3." If instrument readings inside a TU structure exceeded 20 μR/h, a gamma map was made. In many instances, a map was not required; but a sketch showing the location on the property of readings found above 20 μR/h was made. This would be indicated by a "7" in the "Gamma-Map" block on the form (figure 2), and the sketch would be placed on the back of the survey form. If ore or other radioactive material was found, the reading from the material was not recorded as the HIG or HOG, but appeared in the "Free Punch Comment" on the survey form. The survey form was then checked by an EPA field supervisor, a specific location number was assigned to each location, and the form was sent to the ORP-LVF for card punch and data storage.

## Air Sampling

### *Five minute radon in air sample*

A radon gas sample was obtained by drawing filtered air into an evacuated glass flask (2 liter volume). The flask was sealed after about a five-minute collection period and returned to the laboratory for analysis of radon-222.



DATE FORM COMPLETED

CARD A 1
LOCATION No. 2 3 4 5 6
CITY 7 8 9 10
COUNTY 11 12 13
STATE 14 15
MONTH 16 17
YEAR 18 19

ADDRESS

NUMBER 20 21 22 23 24
25
DIR. 26
NAME 27 28 29 30 31 32 33 34 35 36 37 38 39 40

(Last Name First - Initials for first and middle name-husband and wife)
OCCUPANTS NAME 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58

(Last Name First - Initials for first and middle name - husband and wife)
OWNERS NAME 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76

(OWNERS ADDRESS ____________________)

CLASSIFICATION 77
0. Vacant Lot
1. Residence single family
2. Multiple (<4 families)
3. Apartment (>4)
4. Motel, hotel, or hospital
5. Single business (in one unit)
6. Multiple business unit(connected)
7. School
8. Church
9. Other

GAMMA SCREEN 78
0. None
1. Completed
2. Occupant refusal
3. No - ask owner
4. Owner refusal
5. No one to contact
6. No bad address
7. Outside only
8. Special scheduling
9. Other

TAILINGS USE 79
0. None
1. Under
2. Away
3. Under-Away
4. Possible
9. Unknown

GAMMA MAP 80
0. None
1. Yes
2. Occupant - No
3. No ask owner
4. Owner - No
5. No one to see
6. Not required

---

CARD B 1
LOCATION NUMBER 2 3 4 5 6
CITY 7 8 9 10
COUNTY 11 12 13
STATE 14 15

LOCATION CODE
Township 16 17 18 19
Section 20 21
1/4 Sec. 22
Block 24 25
Owner Number 26 27 28
Lot 29 30

HDG 31 32 33 34 35
LOG 36 37 38 39 40
HIG 41 42 43 44 45

LOCATION HIG 46
0. Bedroom
1. Living Room
2. Kitchen
3. Den - Family Rm.
4. Dining Room
5. Attached garage
6. Basement
7. Work shop
8. Other
9. More than one location

TYPE OF HOUSE 47
1. Basement
2. Slab on grade
3. Crawl space
9. Unknown

NUMBER OF LEVELS 48

MATERIAL 49
1. Masonry
2. Non masonry

FREE PUNCH COMMENT
50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65
66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

Figure 2. Indoor Radon Study-Gamma Screening Form

### *Integrated radon in air sample*

A continuous, low-volume sampling system was used to obtain an integrated radon sample. (2) This sampling technique consists of drawing filtered air through a small, low-volume pump (usually less than 10 ml/min sampling rate) into a 30-liter Mylar bag. Usually, a continuous 48-hour air sample was collected and returned to the laboratory for radon-222 analysis.

### *Five minute radon progeny in air sample*

The short-lived particulate radon daughter products (figure 3) were sampled by drawing air through an Acropor filter (Type AN-450, manufactured by the Gelman Instrument Corporation) having a 0.45 μm pore size. Each sample was collected for five minutes at a flow rate of about one cfm. The particulate sample was collected separately from, but simultaneously with, the five-minute grab radon air sample in order to compute the percent equilibrium and the radon daughter to radon concentration ratios.

### *Integrated radon progeny in air sample*

Integrated radon progeny working levels were measured using the TLD-Type II Air Sampler. (3) The detector unit consists of a filter holder containing a membrane filter* and two thermoluminescent dosimeters (TLD's).** One TLD disc is supported above the membrane filter and is exposed to the combination of alpha, beta, and gamma radiations emitted by the radon progeny collected on the filter. The second TLD disc is separated from the first TLD disc by a stainless steel washer that absorbs the beta particles that pass through the first TLD disc. The second TLD disc, therefore, responds to external gamma radiation sources and hence is the radon progeny background subtraction correction. Calibration factors are used to convert the TLD readings (nanocoulombs) to working level (WL)† exposure.

All TLD's were returned to the ORP-LVF for read-out and data analysis.

---

* Millipore Corporation, DAWP01300 (13 mm dia) 0.65 μm pore size.

**Isotopes, Inc., Teflon disk impregnated with Harshaw $CaF_2$:Dy powder (30% by weight).

† Working Level, WL, is defined as any combination of short-lived radon daughters in one liter of air that will result in the ultimate emission of $1.3 \times 10^5$ MeV of alpha energy by decay to lead-210 (RaD).

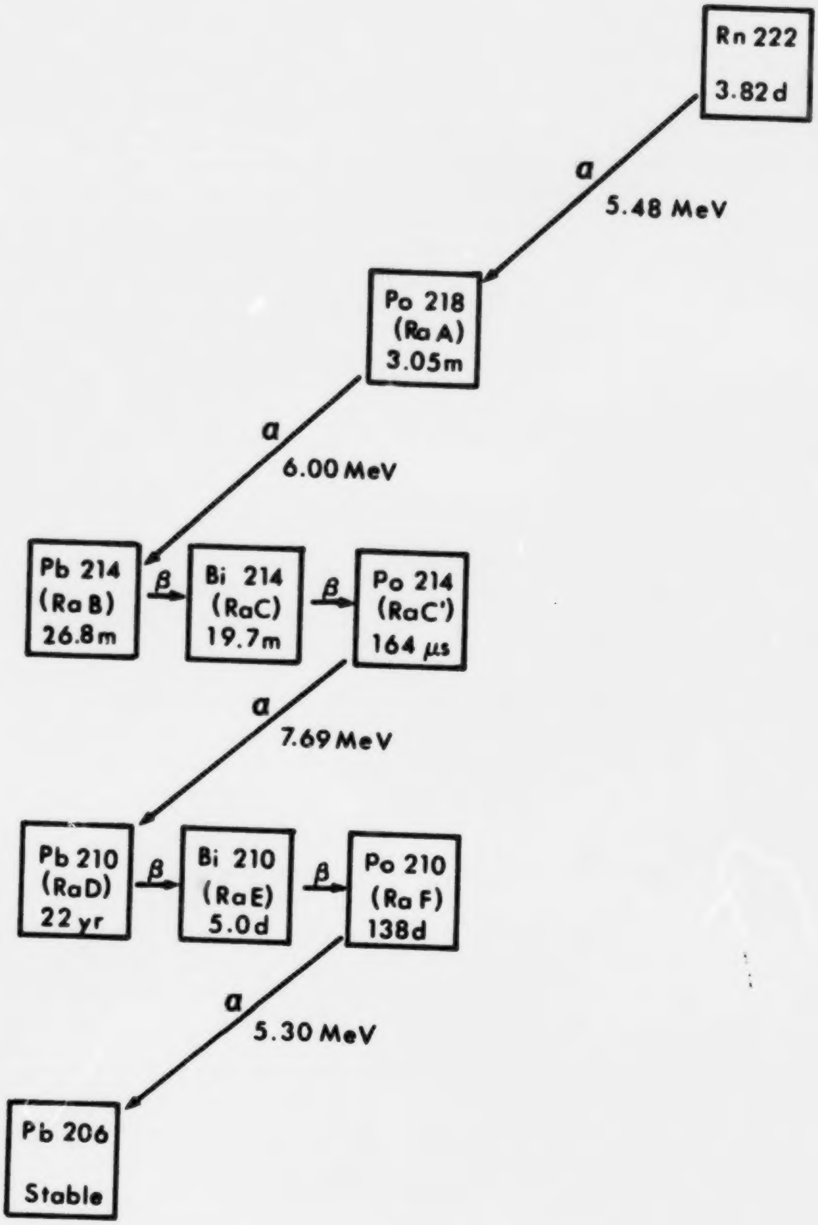

Rn 222
3.82 d
a
5.48 MeV
Po 218
(Ra A)
3.05m
a
6.00 MeV
Pb 214
(Ra B)
26.8m
β
Bi 214
(RaC)
19.7m
β
Po 214
(RaC')
164 μs
a
7.69 MeV
Pb 210
(RaD)
22 yr
β
Bi 210
(Ra E)
5.0d
β
Po 210
(Ra F)
138d
a
5.30 MeV
Pb 206
Stable

Figure 3. Radon and Radon Daughter Decay Scheme

### Meteorology

A mobile weather station having two separate meteorological data-gathering stations was used to obtain information on the wind speed, wind direction, and the ambient temperature. The meteorological trailer is powered by a propane generator and the data are automatically recorded on punch tape which is later read out to provide the meteorological information. Data were usually collected from two locations at 15-minute intervals during the study period. Barometric pressure changes were measured with a standard aircraft altimeter which was reset to a reference altitude.

## Analytical procedures

### Radon concentrations

The radon analysis was performed by cryogenic separation and subsequent alpha scintillation counting. In some cases, a scintillation cell was filled directly from the flask and counted.

The radon decay is calculated to the midpoint of the sample collection period and the radon results are reported in units of picocuries per liter (pCi/l). The decay calculations are performed by a computer program designed for a CDC-6400.

### Radon daughter concentrations

The particulate air filter sample was immediately gross alpha counted in the field utilizing a specially designed alpha scintillation counter. The dpm/cpm for the counter is obtained from certified sources. The radon daughter concentrations and the working level is then calculated using the Thomas equations for the modified Tsivoglou technique. (4) These equations have been incorporated in programs for both the Wang 320K and 362E calculators.

### Integrated working levels

The WL exposure measured by the Radon Progeny Integrating Sampling Unit (3) is determined by the nanocoulomb readout from the TLD's. This measurement of stored charge is obtained with a Harshaw model 2000 reader. The nanocoulomb readout is converted to a WL value by utilizing a working level liter-per-nanocoulomb conversion factor (WL-l/nC) which is obtained by sampling in a known WL atmosphere. The known WL atmosphere is calculated using an alpha spectroscopy system.

## RESULTS--1967 TO 1973

### USPHS--1967 to 1968

From October 27, 1967, through October 9, 1968, a joint study between the U.S. Public Health Service (USPHS) and the U.S. Atomic Energy Commission (AEC) was performed in cooperation with the Utah State Division of Health (UDH). Environmental surveys were conducted during the project to evaluate the public health aspects of atmospheric concentrations of radon-222 in the vicinity of the Vitro uranium mill tailings pile site. The results of this study were reported in "Evaluation of Radon-222 Near Uranium Tailings Piles," U.S. Department of Health, Education, and Welfare, Public Health Service, Report DER 69-1, March 1969. (Figure 4 and tables I through III have been taken from the DER 69-1 report.)

Figure 4 shows the locations of the radon sampling stations used in the 1967-1968 PHS Study. Table I contains the radon concentrations determined for the 48-hour integrated air samples during various sampling periods. The yearly average concentrations for each sampling location are provided in table II. Table III contains the results of the thermoluminescent dosimeters (TL-12's) used to evaluate the external gamma radiation exposure rate.

### USPHS Surveys--November 1970

In November 1970, personnel from the National Environmental Research Center--Las Vegas (NERC-LV) conducted a comprehensive gamma survey of the entire uranium mill tailings pile site and the Suburban Sewage Treatment Plant site. A grid system survey, using both portable gamma survey meters* and thermoluminescent dosimeters (TL-12's), was completed. This study was initiated in order to record the gamma exposure rates over the tailings material before covering the piles with "clean" dirt from the proposed widening of 3300 South Street. The cover work has not been completed to our knowledge; thus, the second (post stabilization) part of the survey has not been performed.

The results of the November 1970 gamma surveys are shown in figures 5 through 7. The portable instrument measurements are given for three feet above ground surface and at the

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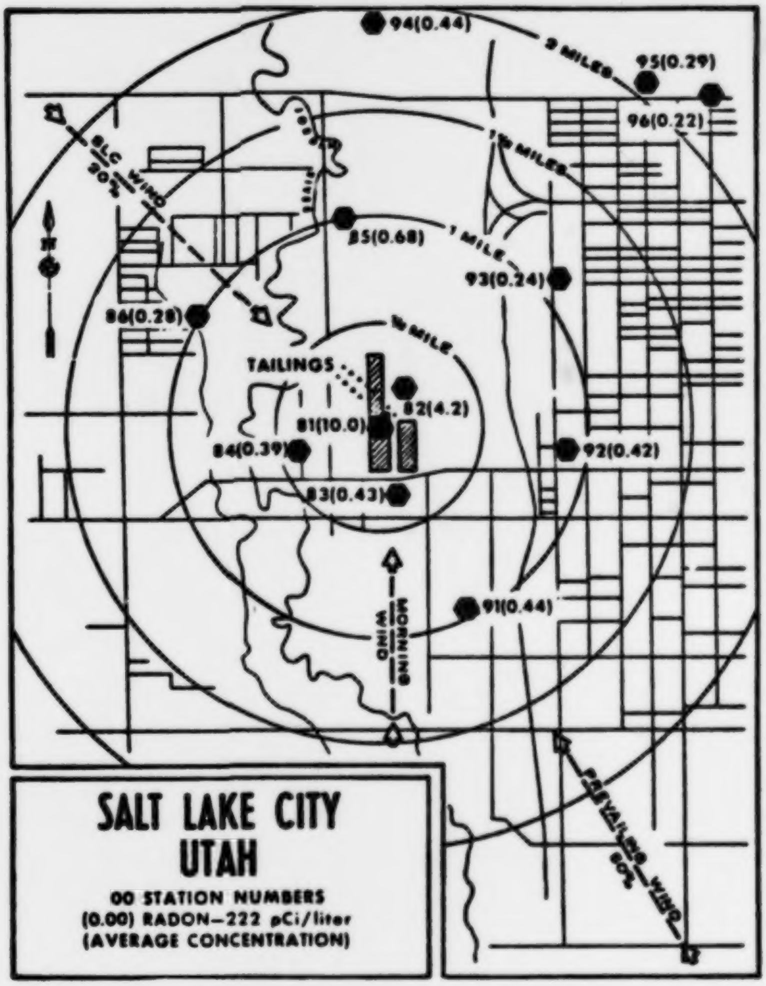
*Eberline Instrument Corporation, Model E-500B.


94(0.44)
2 MILES
95(0.29)
96(0.22)
1½ MILES
SLC WIND 20%
N
85(0.68)
1 MILE
93(0.24)
86(0.28)
½ MILE
TAILINGS
82(4.2)
81(10.0)
84(0.39)
92(0.42)
83(0.43)
MORNING WIND
91(0.44)
PREVAILING WIND 60%
SALT LAKE CITY
UTAH
00 STATION NUMBERS
(0.00) RADON-222 pCi/liter
(AVERAGE CONCENTRATION)

| | |
|---|---|
| 81 | Center of tailings (700 West 3300 South). |
| 82 | Sewage Plant, 650 West 3300 South. |
| 83 | American Smelting & Refining Company, Hygiene & Research Department, 3422 South 7th West. |
| 84 | D. B. Harmon, 1080 West 3300 South. |
| 85 | Bonneville News Company, 965 Beardsley Place. |
| 86 | J. A. Skogg, 1501 West Claybourne Avenue. |
| 91 | D. Bolton, 570 West 3740 South. |
| 92 | Chris Body and Paint Shop Inc., 3152 South 2d West. |
| 93 | Tuloma Gas Products Co., 201 West 27th South. |
| 94 | Aluminum Manufacturing & Supply Co., 1809 South 8th West. |
| 95 | A. H. Higham, 105 Westwood Avenue. |
| 96 | Salt Lake City Health Department, 610 South 2d East. |

Figure 4. Location of Radon Sampling Stations in Salt Lake City, Utah (1967-1968 PHS Study)

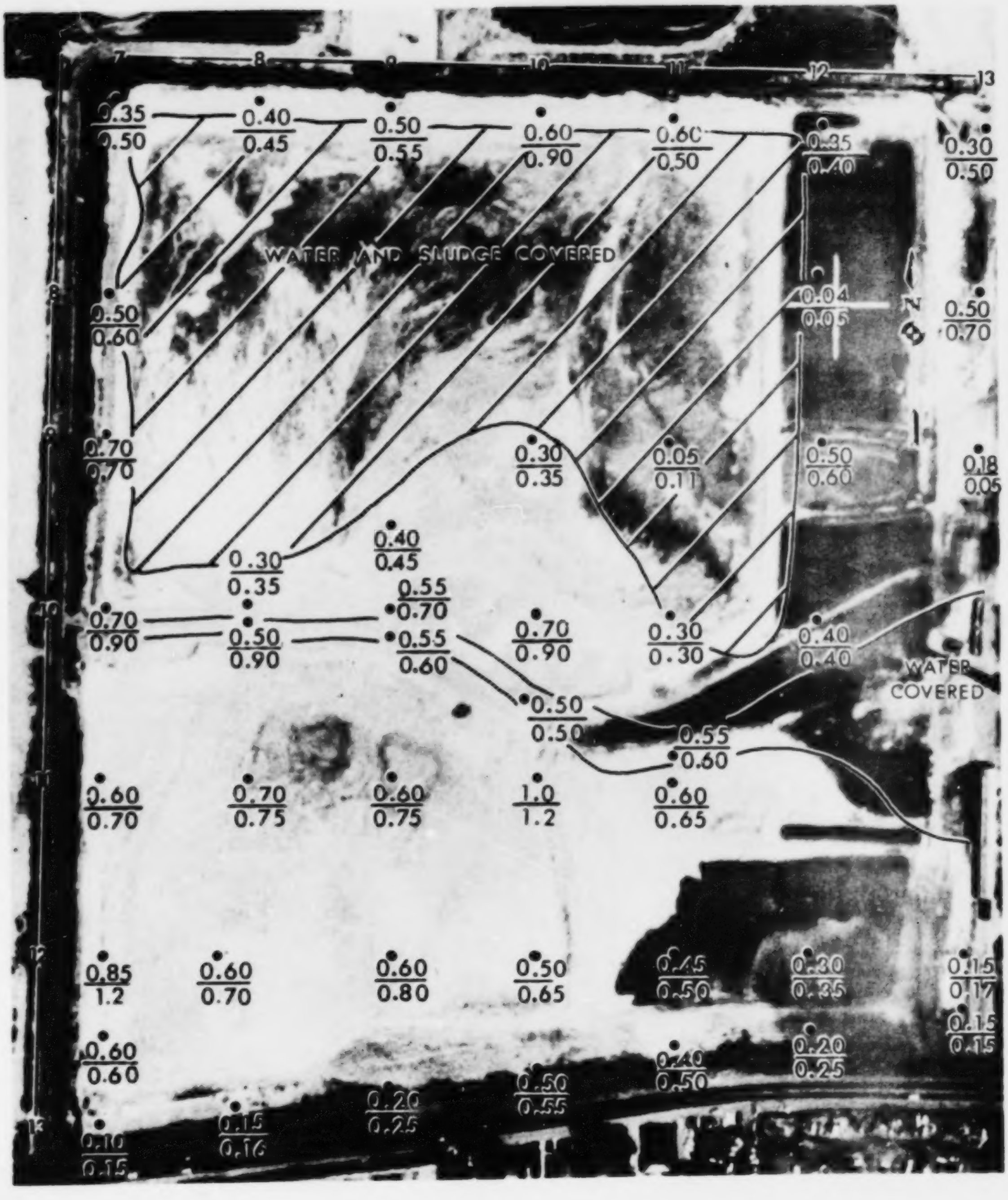

7
8
9
10
11
12
13
8
9
10
11
12
13
0.35/0.50
0.40/0.45
0.50/0.55
0.60/0.90
0.60/0.50
0.35/0.40
0.30/0.50
WATER AND SLUDGE COVERED
0.50/0.60
0.04/0.05
N
0.50/0.70
0.70/0.70
0.30/0.35
0.05/0.11
0.50/0.60
0.18/0.05
0.40/0.45
0.30/0.35
0.55/0.70
0.70/0.90
0.50/0.90
0.55/0.60
0.70/0.90
0.30/0.30
0.40/0.40
WATER COVERED
0.50/0.50
0.55/0.60
0.60/0.70
0.70/0.75
0.60/0.75
1.0/1.2
0.60/0.65
0.85/1.2
0.60/0.70
0.60/0.80
0.50/0.65
0.45/0.50
0.30/0.35
0.15/0.17
0.60/0.60
0.40/0.50
0.20/0.25
0.15/0.15
0.50/0.55
0.20/0.25
0.15/0.16
0.10/0.15

Figure 5. E-500B Gamma Radiation Measurements in mR/h: Salt Lake City, Utah, Vitro Uranium Mill Site: Southeast Tailings Pile (3 ft. reading/ground reading)

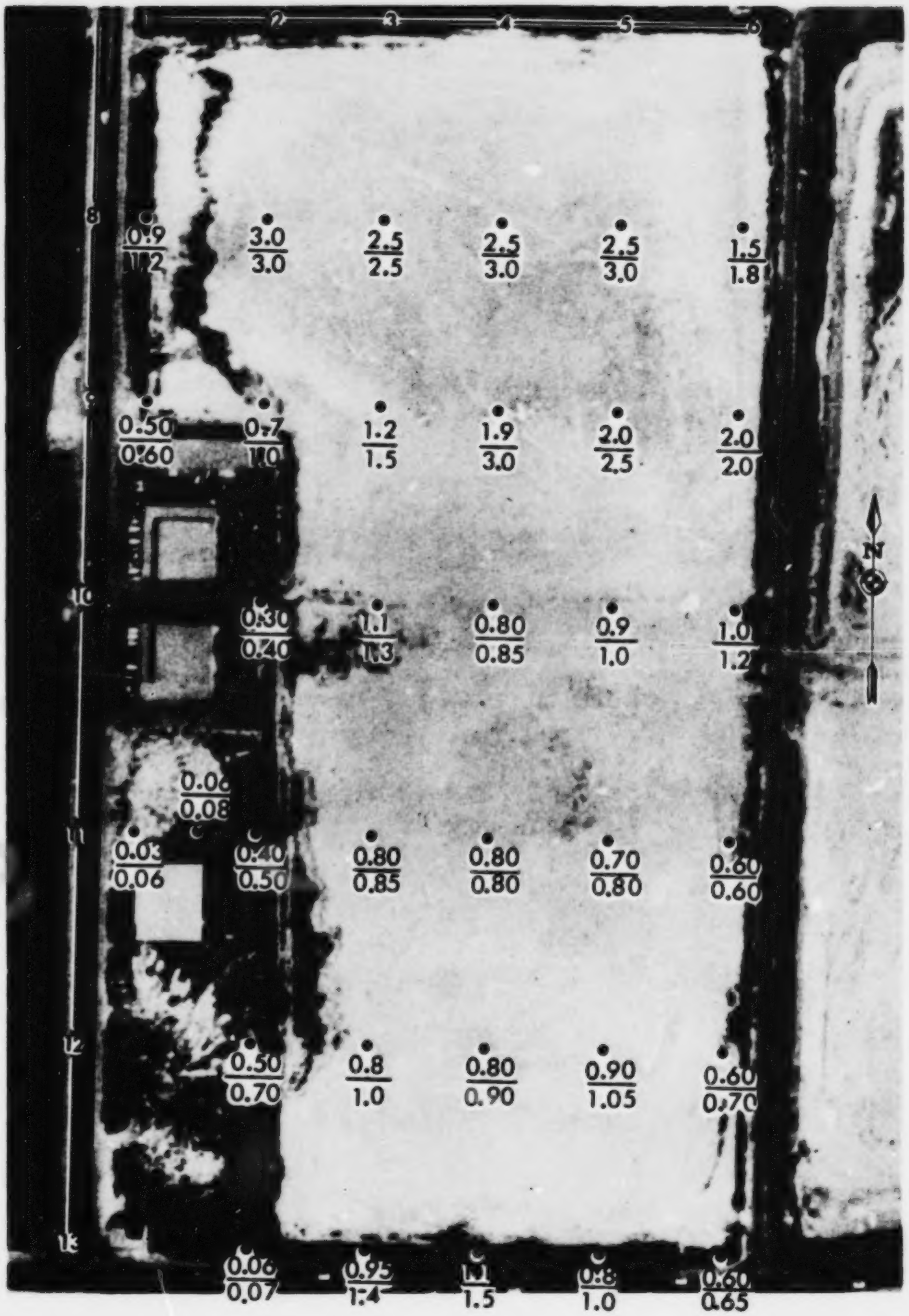

1
2
3
4
5
6
8
9
10
11
12
13
N
0.9/1.2
3.0/3.0
2.5/2.5
2.5/3.0
2.5/3.0
1.5/1.8
0.50/0.60
0.7/1.0
1.2/1.5
1.9/3.0
2.0/2.5
2.0/2.0
0.30/0.40
1.1/1.3
0.80/0.85
0.9/1.0
1.0/1.2
0.06/0.08
0.03/0.06
0.40/0.50
0.80/0.85
0.80/0.80
0.70/0.80
0.60/0.60
0.50/0.70
0.8/1.0
0.80/0.90
0.90/1.05
0.60/0.70
0.06/0.07
0.95/1.4
1.1/1.5
0.8/1.0
0.60/0.65

Figure 6. E-500B Gamma Radiation Measurements in mR/h: Salt Lake City, Utah, Vitro Uranium Mill Site: Southwest Tailings Pile (3 ft. reading/ground reading)

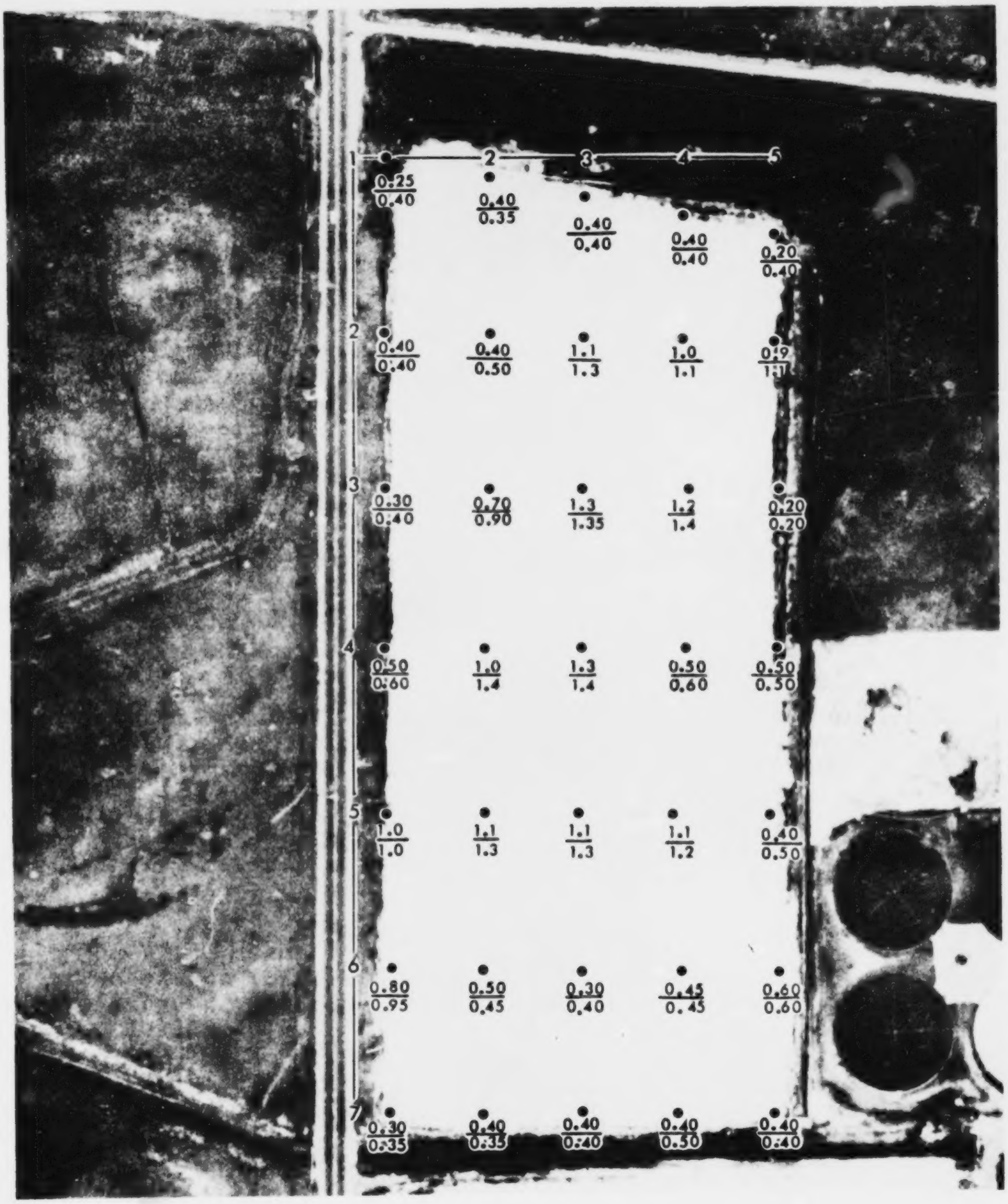

1
2
3
4
5
0.25
0.40
0.40
0.35
0.40
0.40
0.40
0.40
0.20
0.40
2
0.40
0.40
0.40
0.50
1.1
1.3
1.0
1.1
0.9
1.1
3
0.30
0.40
0.70
0.90
1.3
1.35
1.2
1.4
0.20
0.20
4
0.50
0.60
1.0
1.4
1.3
1.4
0.50
0.60
0.50
0.50
5
1.0
1.0
1.1
1.3
1.1
1.3
1.1
1.2
0.40
0.50
6
0.80
0.95
0.50
0.45
0.30
0.40
0.45
0.45
0.60
0.60
7
0.30
0.35
0.40
0.35
0.40
0.40
0.40
0.50
0.40
0.40

Figure 7. E-500B Gamma Radiation Measurements in mR/h: Salt Lake City, Utah, Vitro Uranium Mill Site: Northwest Tailings Pile (3 ft. reading/ground reading)

ground surface. All units are reported in mR/h.* Figure 8 shows the results of the TLD-gamma exposure rate measurements; all units reported in mR/h.*

Also, in November 1970, a gamma survey was completed at the Suburban Sewage Treatment Plant to determine if tailings had been used in the plant construction. The gamma survey maps for several SSTP structures are shown in figures 9 through 12. These results are also given for three feet above ground surface and the ground surface; all units are reported in uncorrected μR/h (meter indication)** since the more sensitive NE-148A scintillometer was used for these surveys. In addition to the detailed gamma surveys conducted at the SSTP, both the five-minute radon air sample and the five-minute radon progeny particulate filter sample was collected in the main building of the SSTP. The results of the air sampling are presented in table IV.

### EPA Gamma Scanning Surveys--April to September 1972

The gamma radiation anomaly list prepared from the Mobile Gamma Scanning Surveys appears in appendix B.

### EPA Gamma Screening Surveys--August to October 1972

The surveys around the Vitro uranium mill site were performed in August 1972. The results of these field surveys are shown in figures 13 through 21. The gamma measurements at three feet above ground surface and at the ground surface, as indicated by a NE-148A meter reading, are reported in "μR/h." Figure 13 shows the gamma surveys of the four business areas located against the southwest section of the tailings piles along South 900 West Street. Figures 20 and 21 show the areas to the west and north of the mill site.

### Radon and Radon Daughter Evaluation--May 1973

During this period, May 2 to 22, 1973, an extensive radon air sampling program was conducted at the site of the inactive Vitro uranium mill tailings pile. This study was conducted at the request of the Governor of the State of Utah. This request was made to an EPA Region VIII representative at a special meeting held in the Governor's office on April 11, 1973. The Governor wanted additional data to

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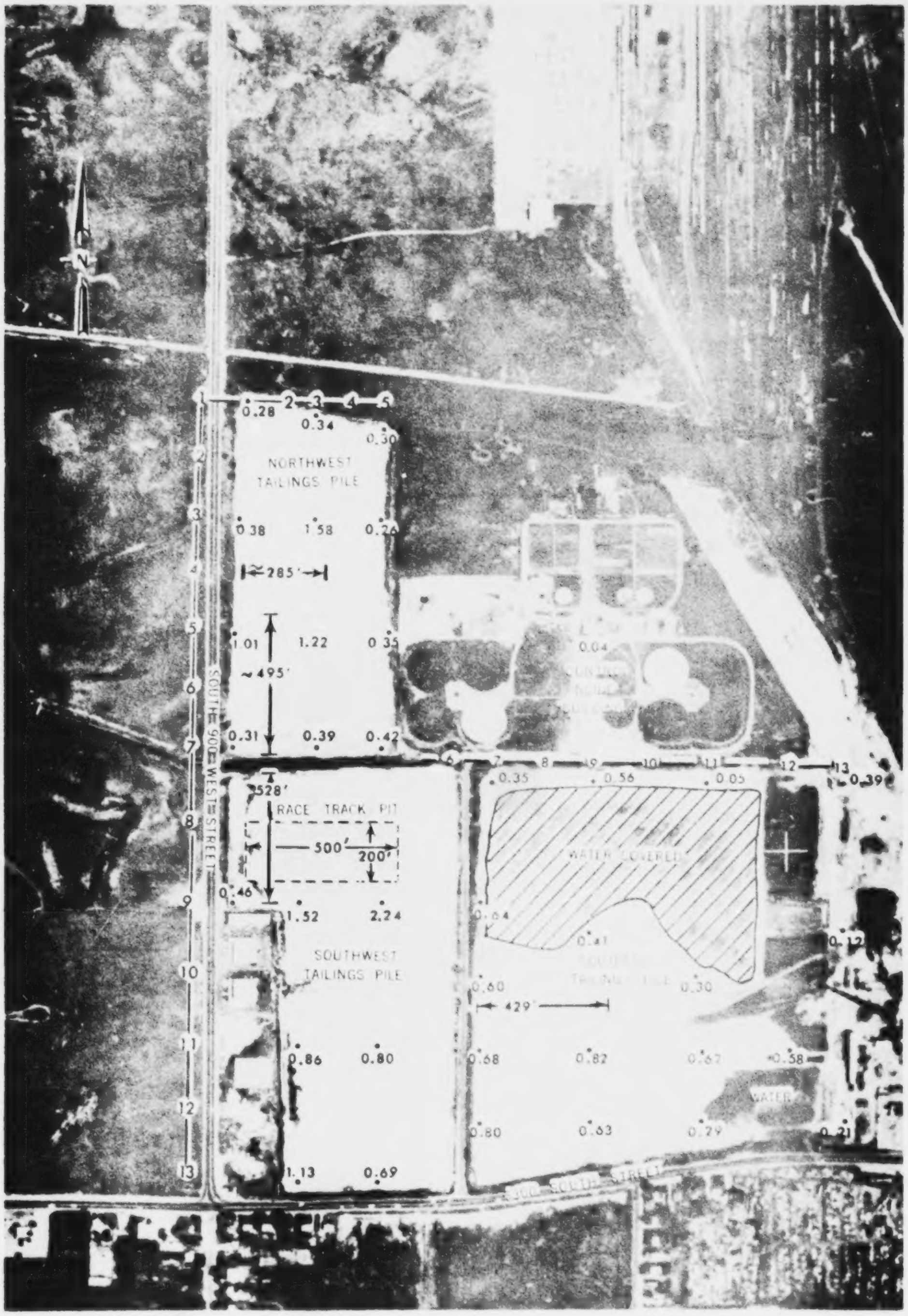
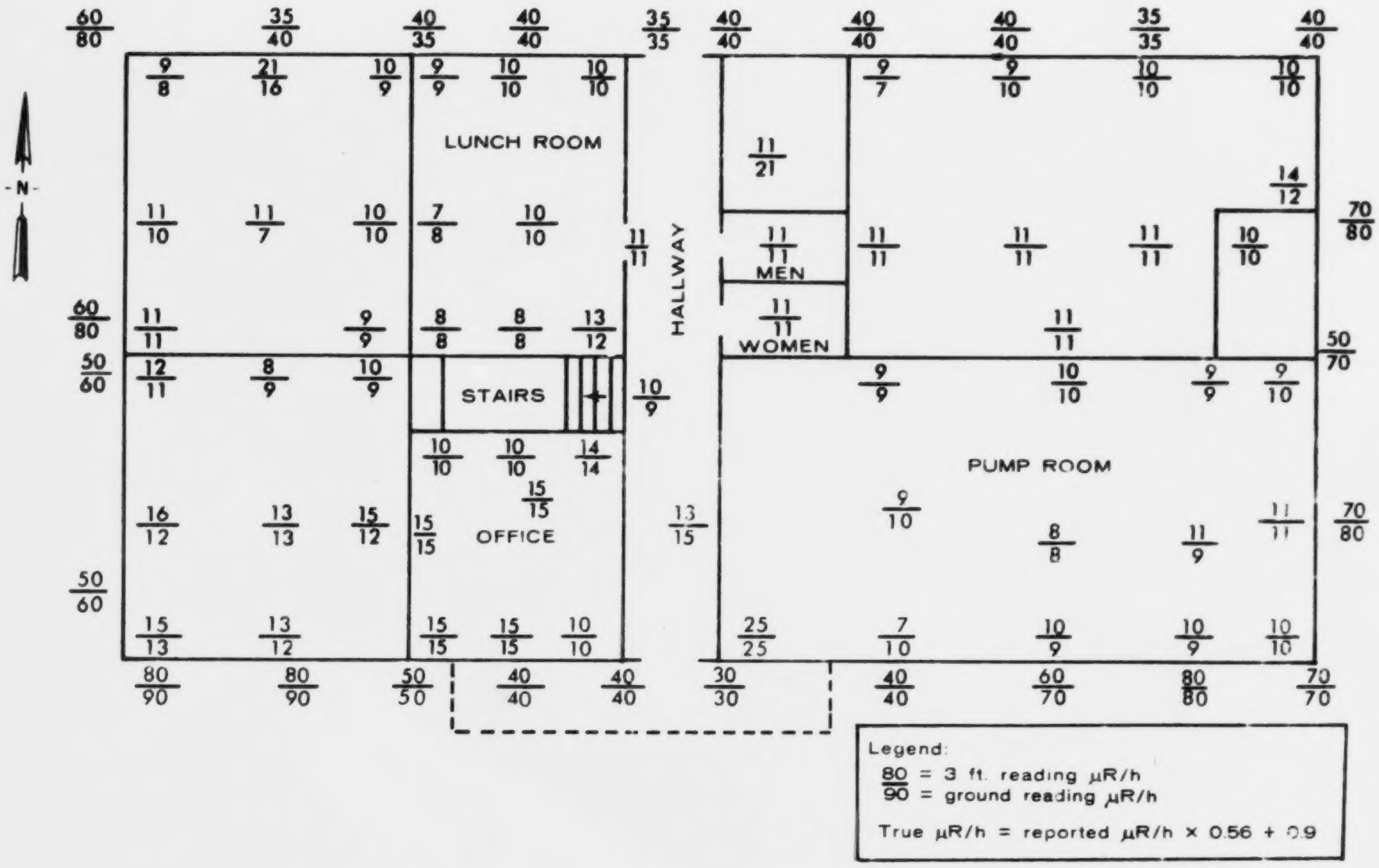
* These measurements do not need to be corrected.

**True μR/h = Reported μR/h x 0.56 + 0.9.



N
NORTHWEST TAILINGS PILE
0.28
0.34
0.30
0.38
1.58
0.26
≈285'
1.01
1.22
0.35
~495'
0.31
0.39
0.42
0.04
528'
RACE TRACK PIT
500'
200'
0.46
1.52
2.24
SOUTHWEST TAILINGS PILE
0.86
0.80
1.13
0.69
0.35
0.56
0.05
0.39
WATER COVERED
0.64
0.41
0.12
0.60
0.30
429'
0.68
0.82
0.67
0.58
WATER
0.80
0.63
0.29
0.21
SOUTH 900 WEST STREET
900 SOUTH STREET

Figure 8. TLD Gamma Radiation Measurements in mR/h: Salt Lake City, Utah, Vitro Uranium Mill Tailings Pile



N
LUNCH ROOM
STAIRS
OFFICE
HALLWAY
MEN
WOMEN
PUMP ROOM
60/80
35/40
40/35
40/40
35/35
40/40
40/40
40/40
35/35
40/40
9/8
21/16
10/9
9/9
10/10
10/10
9/7
9/10
10/10
10/10
11/21
14/12
70/80
11/10
11/7
10/10
7/8
10/10
11/11
11/11
11/11
11/11
11/11
11/11
10/10
60/80
11/11
9/9
8/8
8/8
13/12
11/11
11/11
50/70
50/60
12/11
8/9
10/9
10/9
9/9
10/10
9/9
9/10
10/10
10/10
14/14
15/15
16/12
13/13
15/12
15/15
13/15
9/10
8/8
11/9
11/11
70/80
50/60
15/13
13/12
15/15
15/15
10/10
25/25
7/10
10/9
10/9
10/10
80/90
80/90
50/50
40/40
40/40
30/30
40/40
60/70
80/80
70/70
Legend:
80/90 = 3 ft. reading µR/h
= ground reading µR/h
True µR/h = reported µR/h × 0.56 + 0.9

Figure 9. Gamma Survey Map, Suburban Sewage Treatment Plant, Salt Lake City, Utah, November 1970 (NE-148A readings in µR/h) Ground Floor Main Building

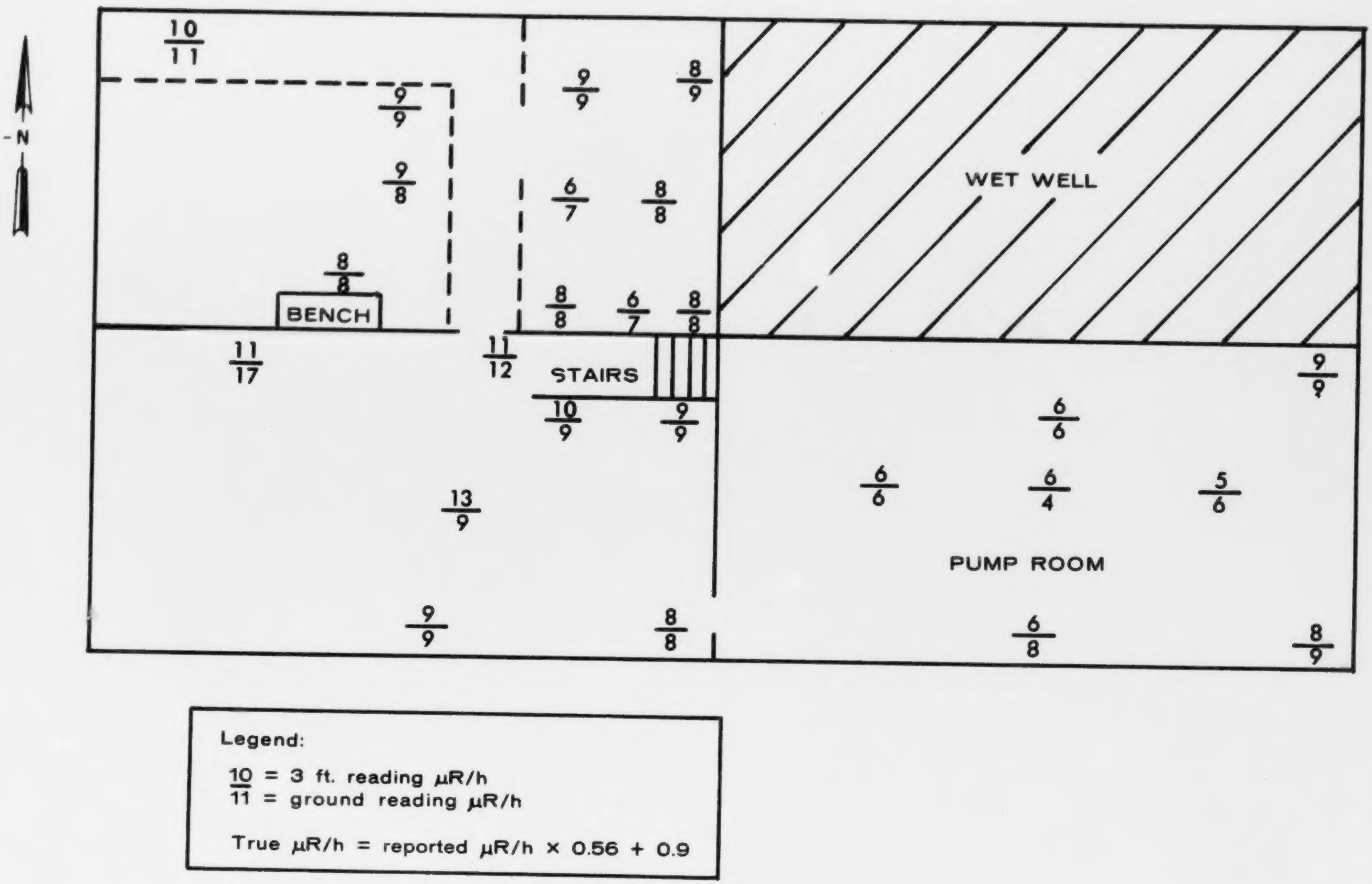

N
WET WELL
PUMP ROOM
STAIRS
BENCH
10/11
9/9
9/8
8/8
11/17
11/12
13/9
9/9
9/9
8/9
6/7
8/8
8/8
6/7
8/8
10/9
9/9
8/8
9/9
6/6
6/6
6/4
5/6
6/8
8/9
Legend:
10/11
10 = 3 ft. reading μR/h
11 = ground reading μR/h
True μR/h = reported μR/h × 0.56 + 0.9

Figure 10. Gamma Survey Map, Suburban Sewage Treatment Plant, Basement Main Building, Salt Lake City, Utah, November 1970 (NE-148A readings in μR/h)

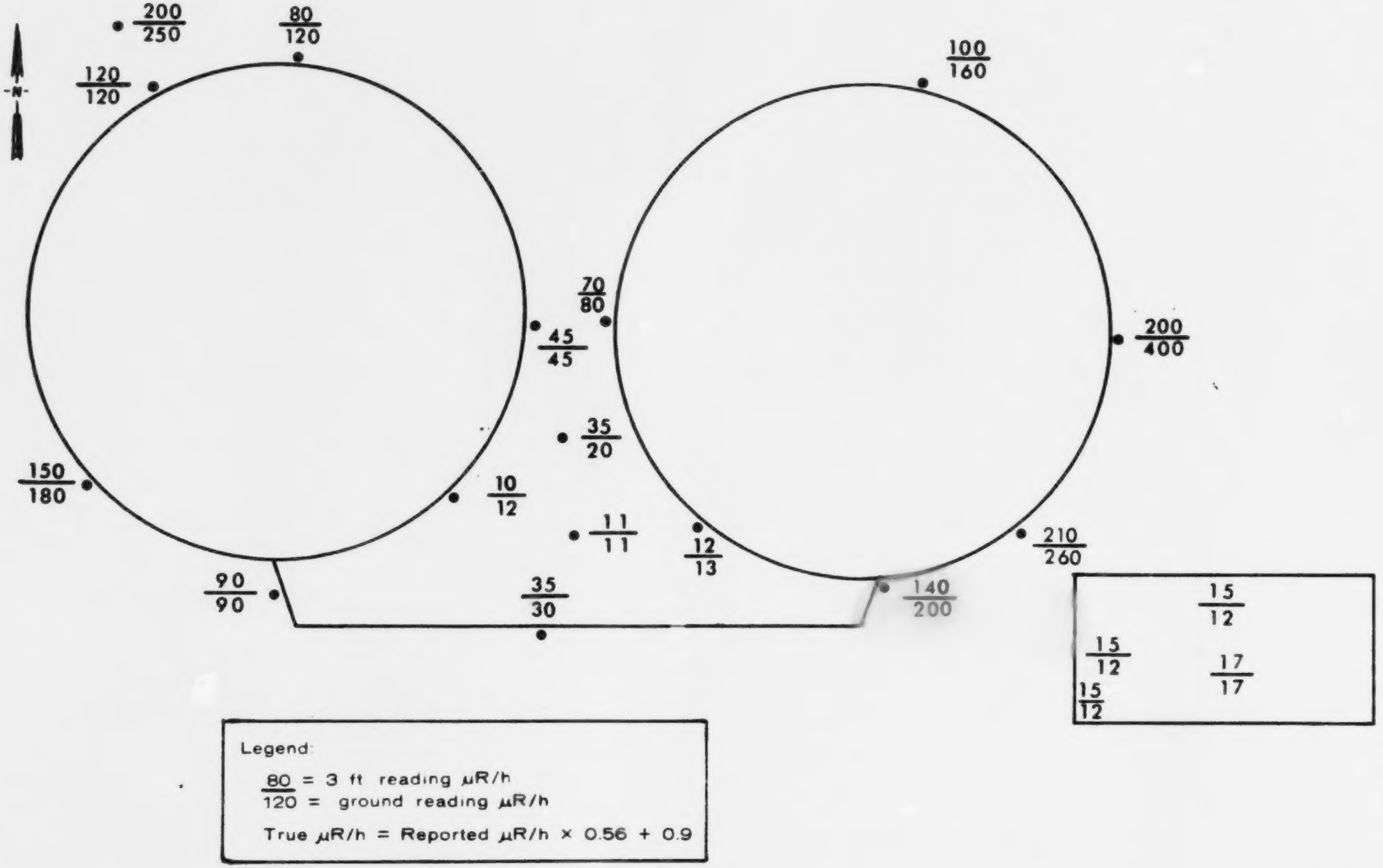
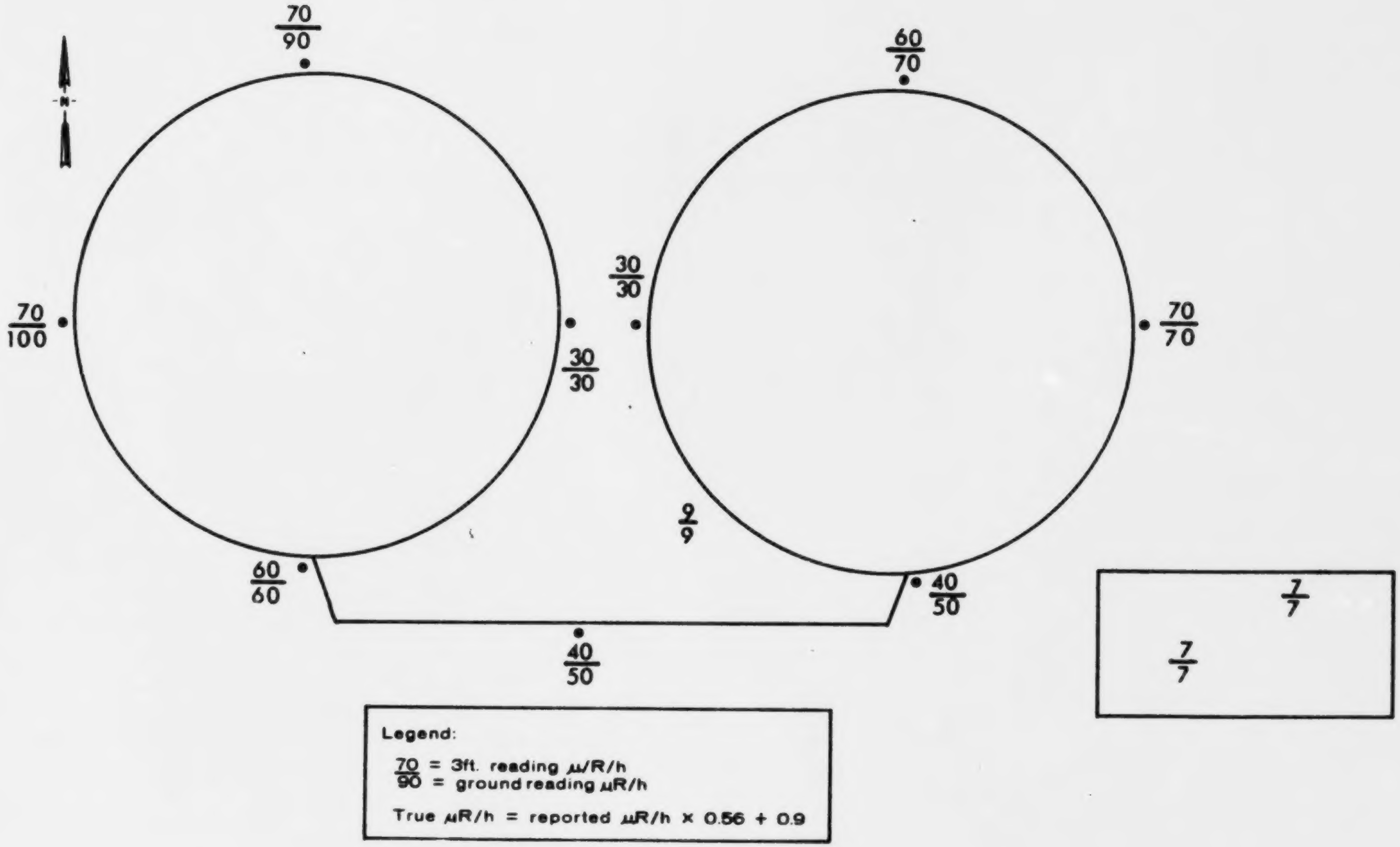
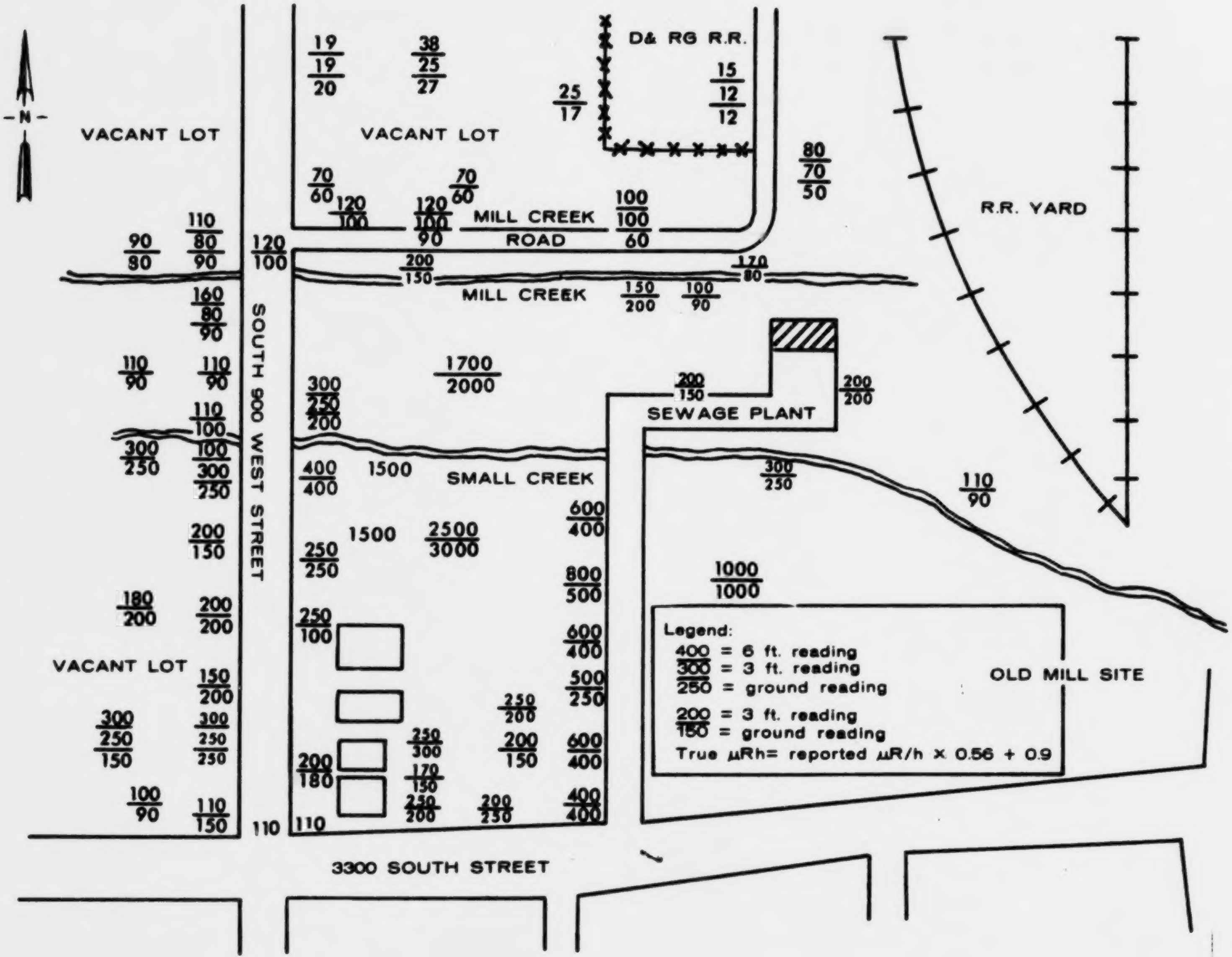

N
200/250
80/120
120/120
100/160
70/80
45/45
200/400
35/20
150/180
10/12
11/11
12/13
210/260
90/90
35/30
140/200
15/12
15/12
17/17
15/12
Legend:
80/120
80 = 3 ft reading μR/h
120 = ground reading μR/h
True μR/h = Reported μR/h × 0.56 + 0.9

Figure 11. Gamma Survey Map, Suburban Sewage Treatment Plant, West Digester, Salt Lake City, Utah, November 1970 (NE-148A readings in μR/h)



N
70
90
60
70
30
30
70
100
30
30
70
70
9
9
60
60
40
50
7
7
7
7
40
50
Legend:
70 = 3ft. reading μR/h
90 = ground reading μR/h
True μR/h = reported μR/h × 0.56 + 0.9

Figure 12. Gamma Survey Map, Suburban Sewage Treatment Plant, East Digester, Salt Lake City, Utah, November 1970 (NE-148A reading in μR/h)



N
VACANT LOT
VACANT LOT
VACANT LOT
D& RG R.R.
R.R. YARD
MILL CREEK ROAD
MILL CREEK
SMALL CREEK
SEWAGE PLANT
SOUTH 900 WEST STREET
3300 SOUTH STREET
OLD MILL SITE
19/19/20
38/25/27
25/17
15/12/12
80/70/50
70/60
120/100
120/100/90
70/60
100/100/60
90/80
110/80/90
120/100
200/150
170/80
150/200
100/90
160/80/90
110/90
110/90
1700/2000
200/150
200/200
300/250/200
110/100/100
300/250
300/250
400/400
1500
300/250
110/90
200/150
1500
2500/3000
600/400
800/500
250/250
180/200
200/200
250/100
600/400
1000/1000
150/200
500/250
300/250/150
300/250/250
250/200
250/300
200/150
600/400
200/180
170/150
100/90
110/150
110
110
250/200
200/250
400/400
Legend:
400 = 6 ft. reading
300 = 3 ft. reading
250 = ground reading
200 = 3 ft. reading
150 = ground reading
True µRh= reported µR/h × 0.56 + 0.9

Figure 13. Gamma Survey Map - Area Surrounding the Vitro Uranium Mill and Tailings Pile Site, Salt Lake City, Utah

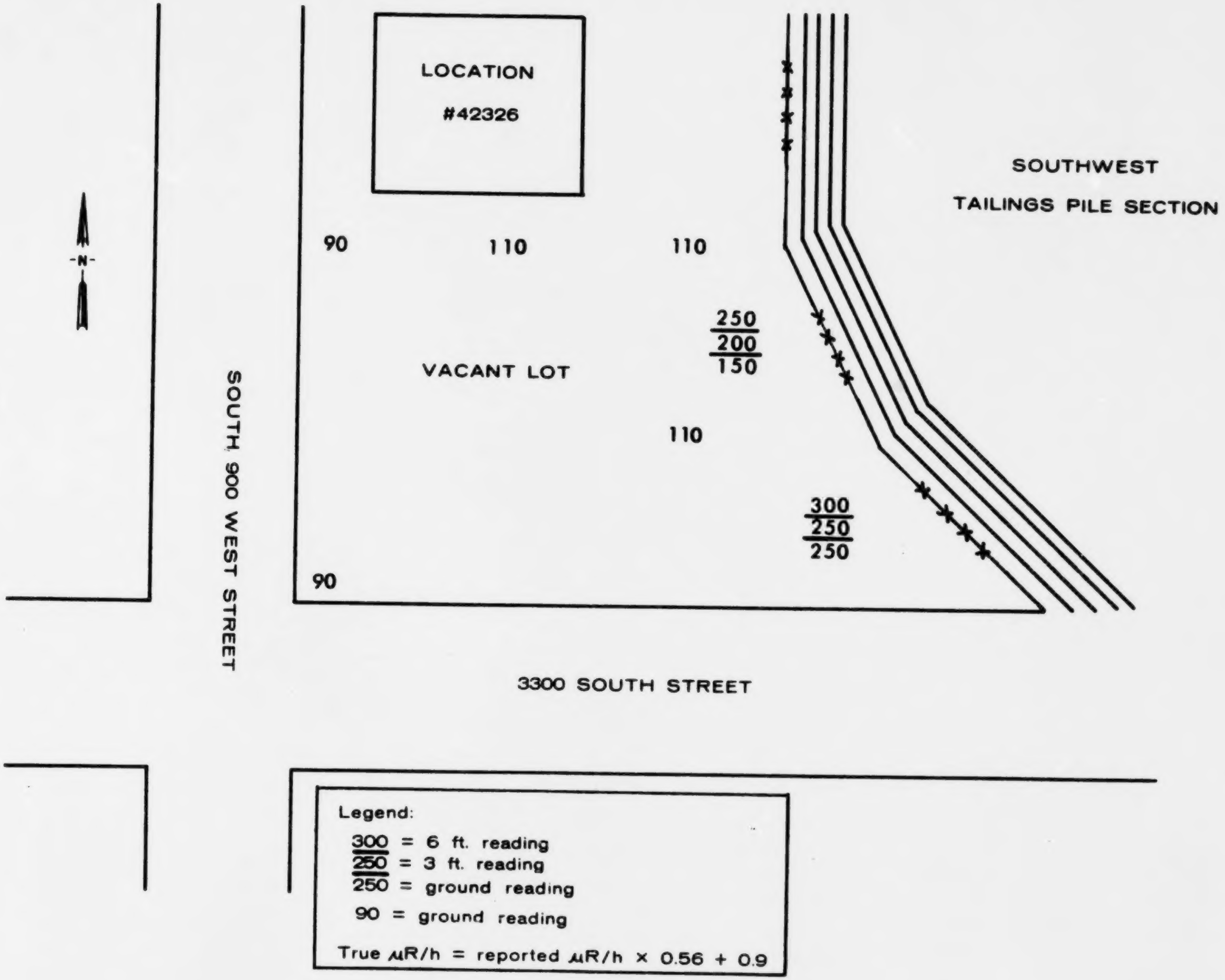

LOCATION
#42326
SOUTHWEST
TAILINGS PILE SECTION
90
110
110
250
200
150
VACANT LOT
110
300
250
250
90
SOUTH 900 WEST STREET
3300 SOUTH STREET
-N-
Legend:
300 = 6 ft. reading
250 = 3 ft. reading
250 = ground reading
90 = ground reading
True µR/h = reported µR/h × 0.56 + 0.9

Figure 14. Gamma Survey Map, Location 42325 (Vacant Lot) Salt Lake City, Utah

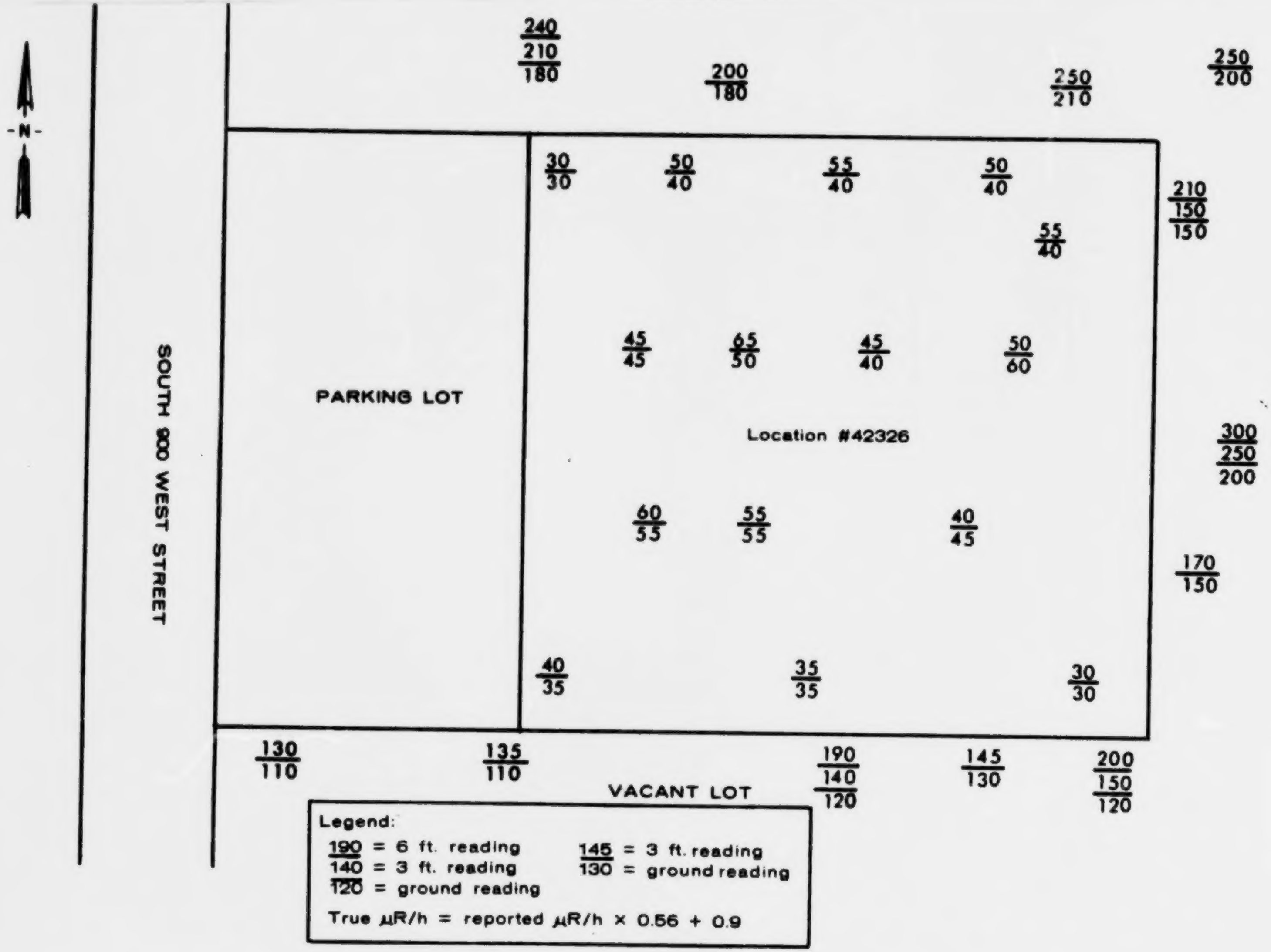
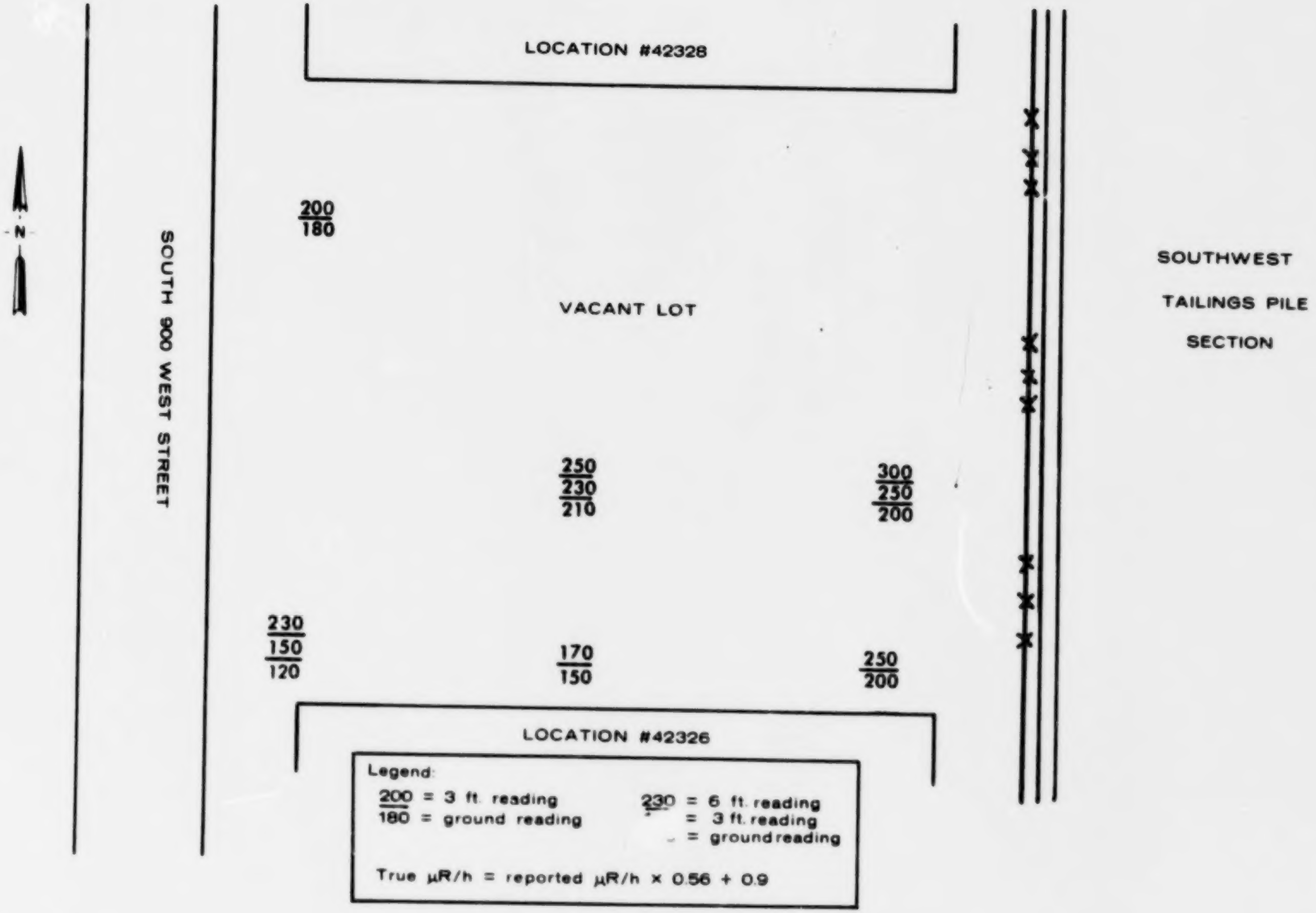

N
SOUTH 900 WEST STREET
PARKING LOT
VACANT LOT
Location #42326
240
210
180
200
180
250
210
250
200
30
30
50
40
55
40
50
40
55
40
210
150
150
45
45
65
50
45
40
50
60
300
250
200
60
55
55
55
40
45
170
150
40
35
35
35
30
30
130
110
135
110
190
140
120
145
130
200
150
120
Legend:
190 = 6 ft. reading
140 = 3 ft. reading
120 = ground reading
145 = 3 ft. reading
130 = ground reading
True μR/h = reported μR/h × 0.56 + 0.9

Figure 15. Gamma Survey Map, Location 42326, Salt Lake City, Utah



LOCATION #42328
200
180
VACANT LOT
SOUTHWEST
TAILINGS PILE
SECTION
N
SOUTH 900 WEST STREET
250
230
210
300
250
200
230
150
120
170
150
250
200
LOCATION #42326
Legend:
200 = 3 ft. reading
180 = ground reading
230 = 6 ft. reading
= 3 ft. reading
= ground reading
True μR/h = reported μR/h × 0.56 + 0.9

Figure 16. Gamma Survey Map, Location 42327 (Vacant Lot) Salt Lake City, Utah

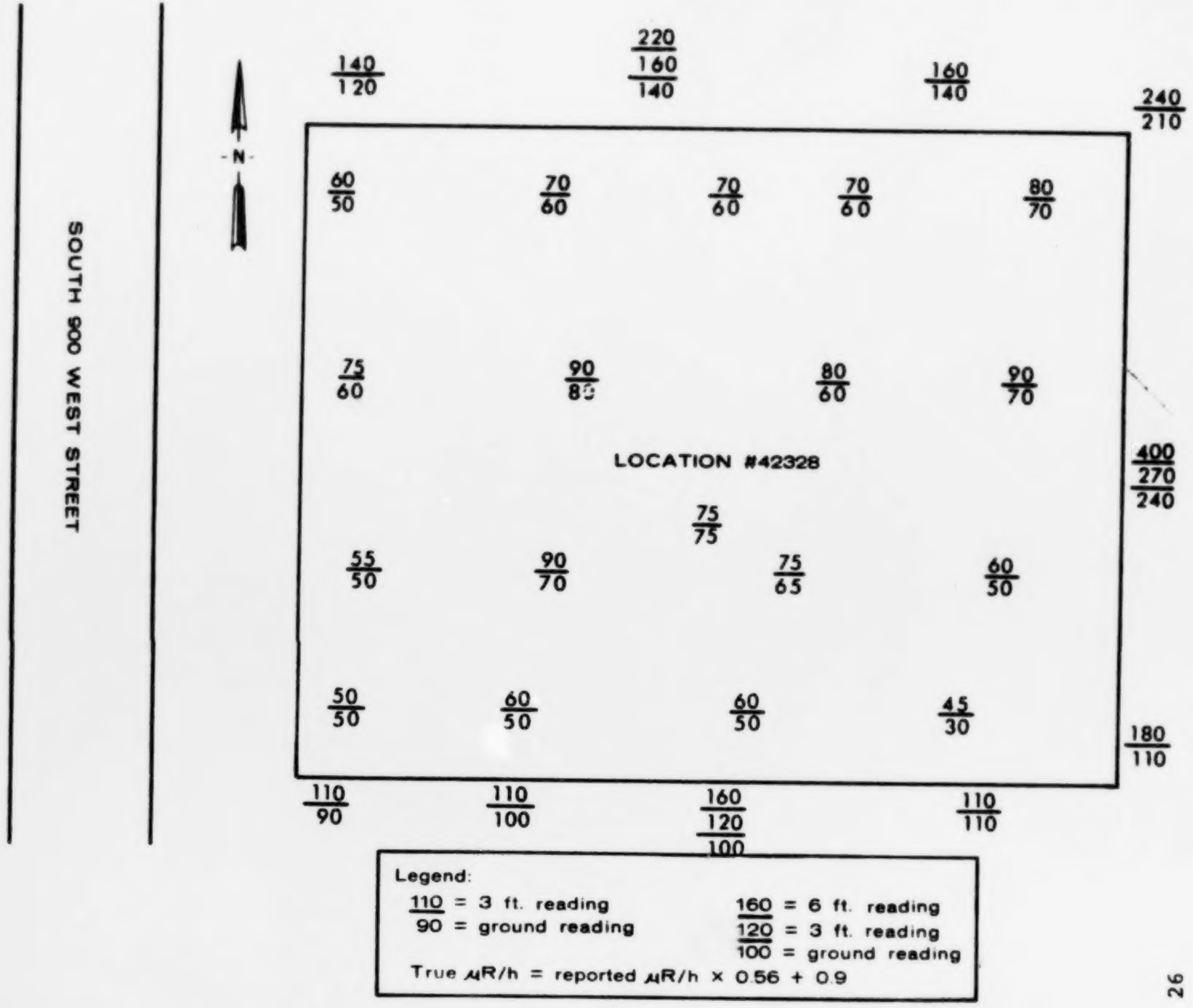
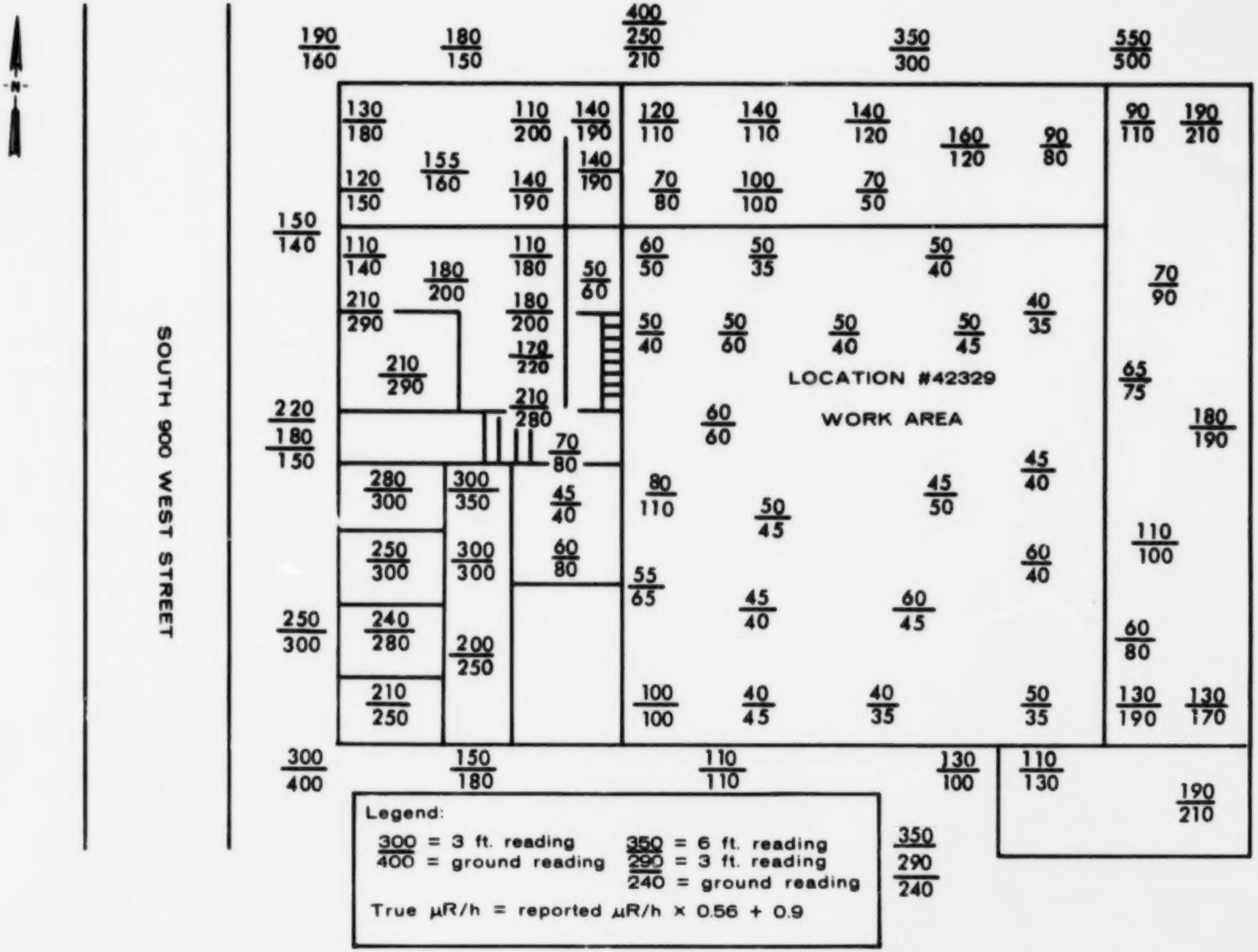

SOUTH 900 WEST STREET
N
140/120
220/160/140
160/140
240/210
60/50
70/60
70/60
70/60
80/70
75/60
90/80
80/60
90/70
LOCATION #42328
400/270/240
75/75
55/50
90/70
75/65
60/50
50/50
60/50
60/50
45/30
180/110
110/90
110/100
160/120/100
110/110
Legend:
110 = 3 ft. reading
90 = ground reading
160 = 6 ft. reading
120 = 3 ft. reading
100 = ground reading
True μR/h = reported μR/h × 0.56 + 0.9

Figure 17. Gamma Survey Map - Location 42328, Salt Lake City, Utah



SOUTH 900 WEST STREET
N
LOCATION #42329
WORK AREA
190/160
180/150
400/250/210
350/300
550/500
130/180
155/160
110/200
140/190
140/190
120/150
140/190
120/110
140/110
140/120
160/120
90/80
90/110
190/210
70/80
100/100
70/50
150/140
110/140
180/200
110/180
50/60
60/50
50/35
50/40
70/90
210/290
180/200
170/220
50/40
50/60
50/40
50/45
40/35
210/290
210/280
65/75
220/180/150
60/60
180/190
70/80
280/300
300/350
45/40
80/110
50/45
45/50
45/40
250/300
300/300
60/80
110/100
55/65
45/40
60/45
60/40
250/300
240/280
200/250
60/80
210/250
100/100
40/45
40/35
50/35
130/190
130/170
300/400
150/180
110/110
130/100
110/130
190/210
350/290/240
Legend:
300/400 = 3 ft. reading / = ground reading
350/290/240 = 6 ft. reading / = 3 ft. reading / = ground reading
True μR/h = reported μR/h × 0.56 + 0.9

Figure 18. Gamma Survey Map, Location 42329, Salt Lake City, Utah

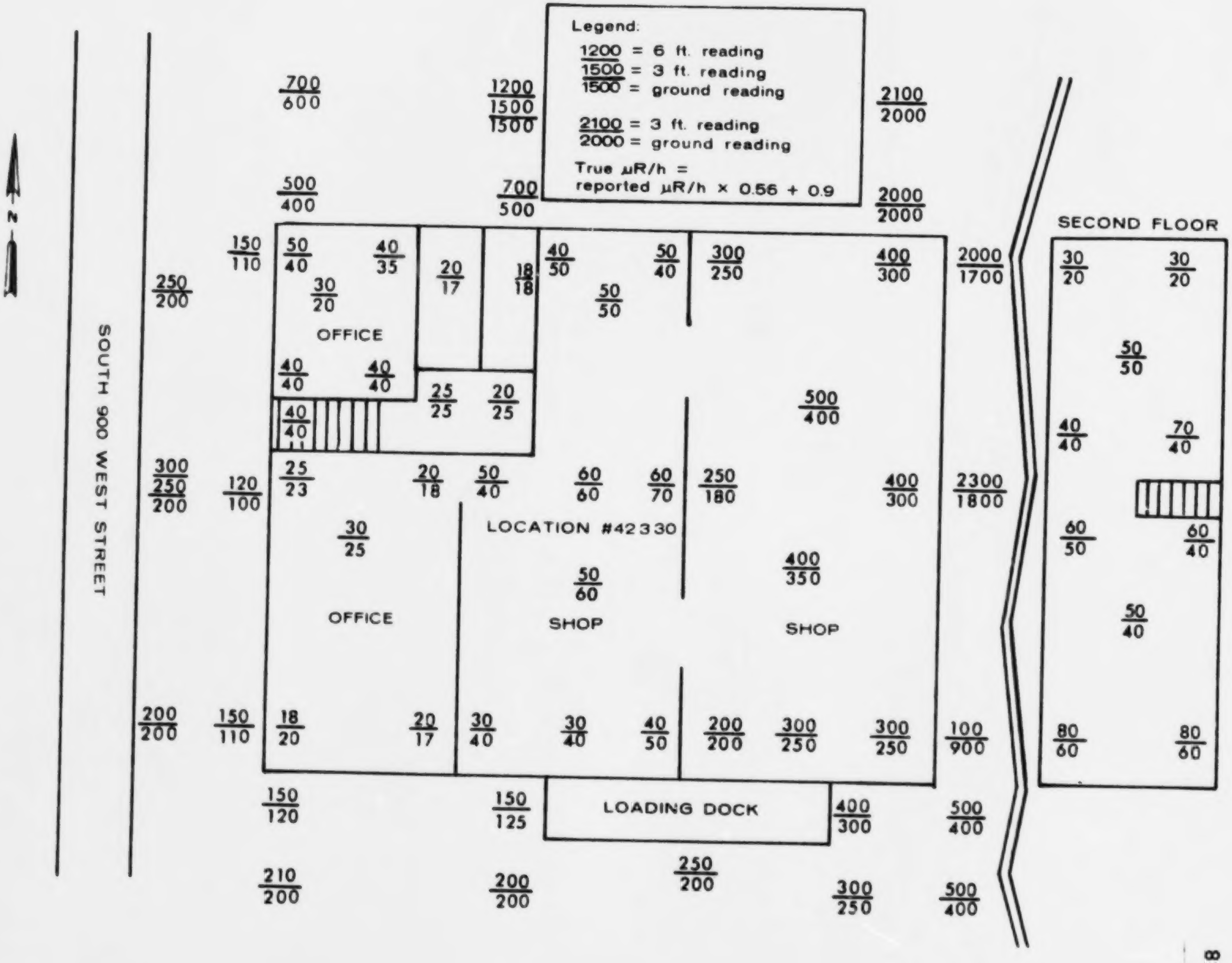

N
SOUTH 900 WEST STREET
Legend:
1200 = 6 ft. reading
1500 = 3 ft. reading
1500 = ground reading
2100 = 3 ft. reading
2000 = ground reading
True μR/h =
reported μR/h × 0.56 + 0.9
OFFICE
OFFICE
LOCATION #42330
SHOP
SHOP
LOADING DOCK
SECOND FLOOR

Figure 19. Gamma Survey Map - Location 42330, Salt Lake City, Utah

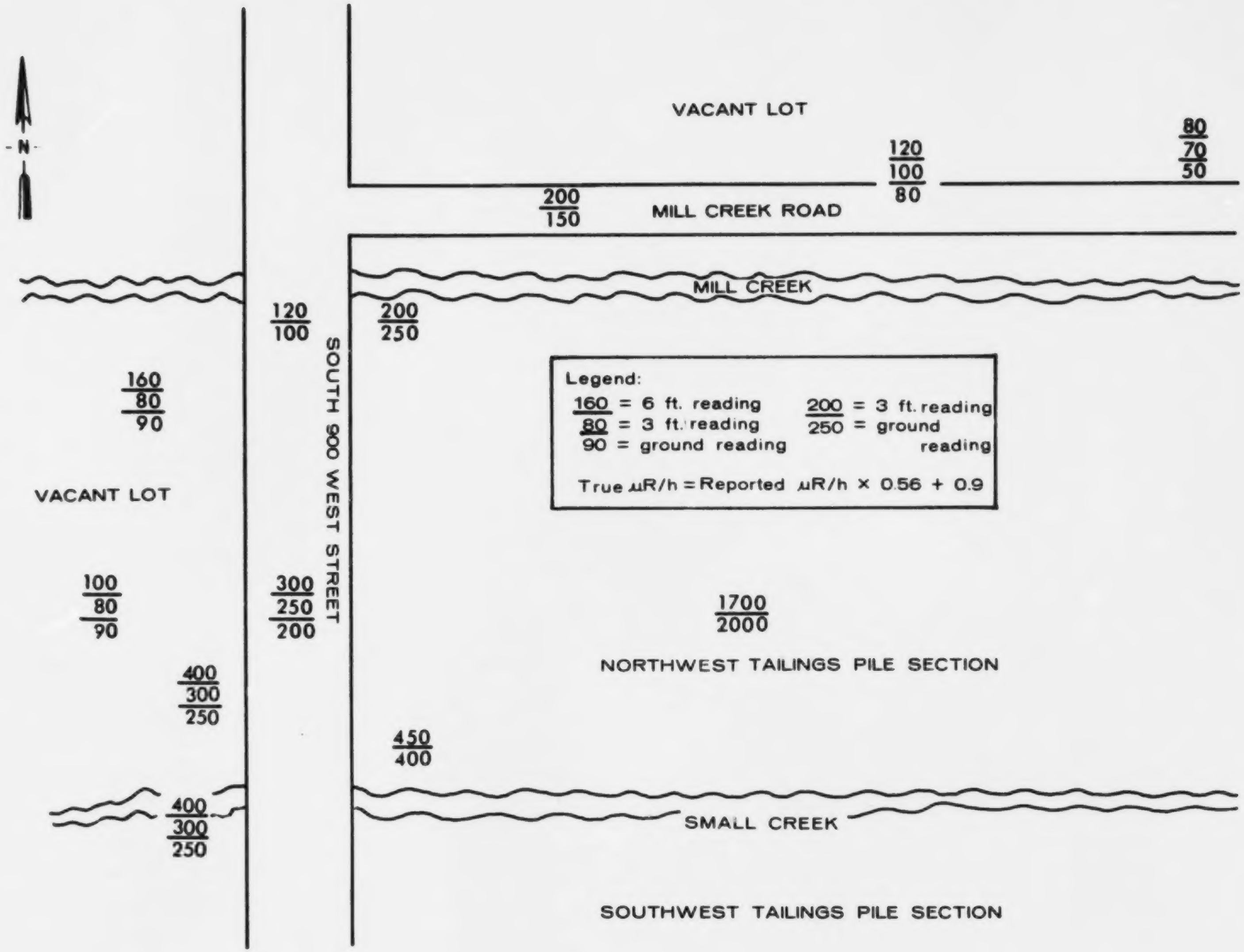
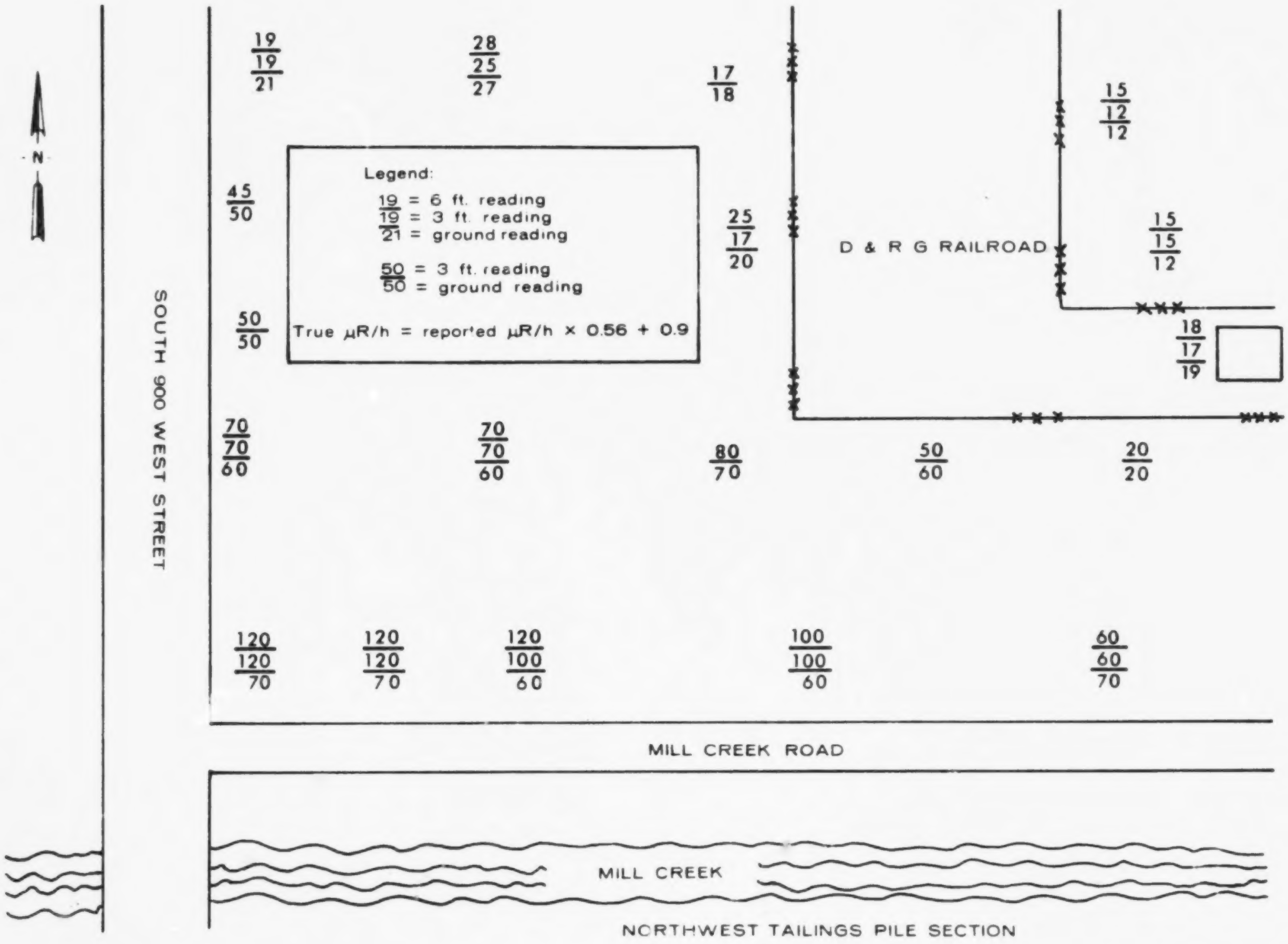

N
VACANT LOT
120
100
80
80
70
50
200
150
MILL CREEK ROAD
MILL CREEK
120
100
SOUTH 900 WEST STREET
200
250
160
80
90
Legend:
160 = 6 ft. reading
80 = 3 ft. reading
90 = ground reading
200 = 3 ft. reading
250 = ground reading
True µR/h = Reported µR/h × 0.56 + 0.9
VACANT LOT
100
80
90
300
250
200
1700
2000
NORTHWEST TAILINGS PILE SECTION
400
300
250
450
400
400
300
250
SMALL CREEK
SOUTHWEST TAILINGS PILE SECTION

Figure 20. Gamma Survey Map - Location 42331 (Vacant Land West of Tailings Pile)
Salt Lake City, Utah


N
SOUTH 900 WEST STREET
19/19/21
28/25/27
17/18
15/12/12
45/50
25/17/20
D & R G RAILROAD
15/15/12
50/50
18/17/19
70/70/60
70/70/60
80/70
50/60
20/20
120/120/70
120/120/70
120/100/60
100/100/60
60/60/70
MILL CREEK ROAD
MILL CREEK
NORTHWEST TAILINGS PILE SECTION

Legend:
$\frac{19}{\frac{19}{21}}$ — 19 = 6 ft. reading, 19 = 3 ft. reading, 21 = ground reading

$\frac{50}{50}$ — 50 = 3 ft. reading, 50 = ground reading

True μR/h = reported μR/h × 0.56 + 0.9

Figure 21. Gamma Survey Map - Location 42332 (Vacant Land North of Tailings Pile) Salt Lake City, Utah

evaluate the potential radiological hazards associated with the operation of an automobile race track proposed for the southwest section of the tailings pile. As described earlier, by April 1973, a pit had been dug out of the tailings pile, resulting in an excavation about 15 feet deep, 200 feet wide, and 500 feet long. The tailings material removed from the pit was piled on the surrounding pile to form hills about 10 to 20 feet high. This study was completed by EPA, ORP-LVF, with the assistance of the Utah State Division of Health and EPA, Region VIII personnel. Included were radon and radon daughter evaluations at the tailings pile, the Suburban Sewage Treatment Plant, and in the four business buildings on South 900 West Street.

Figure 22 shows the air sampling locations selected for this study. Location #75001 was the station setup on the floor of the race track pit dug out of the tailings pile. This station was located about 50 feet away from the wall of the pit. The pit was approximately 15 feet deep at this point. Portions of the pit floor were covered with from one to six inches of water during the sampling period. Location #75002 was an indoor station in the "lunch room" of the Suburban Sewage Treatment Plant. The SSTP is surrounded by the tailings pile on its south and west boundaries, but none of the habitable SSTP buildings appear to have been constructed over uranium mill tailings. Location #75003 was the station setup on the southwest section of the tailings pile. Most of the area surrounding Location #75003 was covered by dirt, concrete, and asphalt road debris. Location #75004 was the station setup at the perimeter fence between the Won-Door Corporation and the tailings pile at the southwest end of the excavated pile.

Four stations were located indoors at the business buildings on South 900 West Street. Location #42326 was an office reception area of the Sierra Corporation at 3275 South 900 West Street. Location #42328 was the main stock room of Inventory Sales at 3227 South 900 West Street. Location #42329 was the main assembly room of the Won-Door Corporation at 3215 South 900 West Street. Location #42330 was the rear assembly area of the Won-Door Corporation at 3195 South 900 West Street.

Several different radon air sampling methods were used at the various locations. A TLD-Type II air sampler was installed at each of the locations to measure the integrated radon progeny working level. An integrating air sampler for the determination of $^{222}$Rn was used at locations #75001,

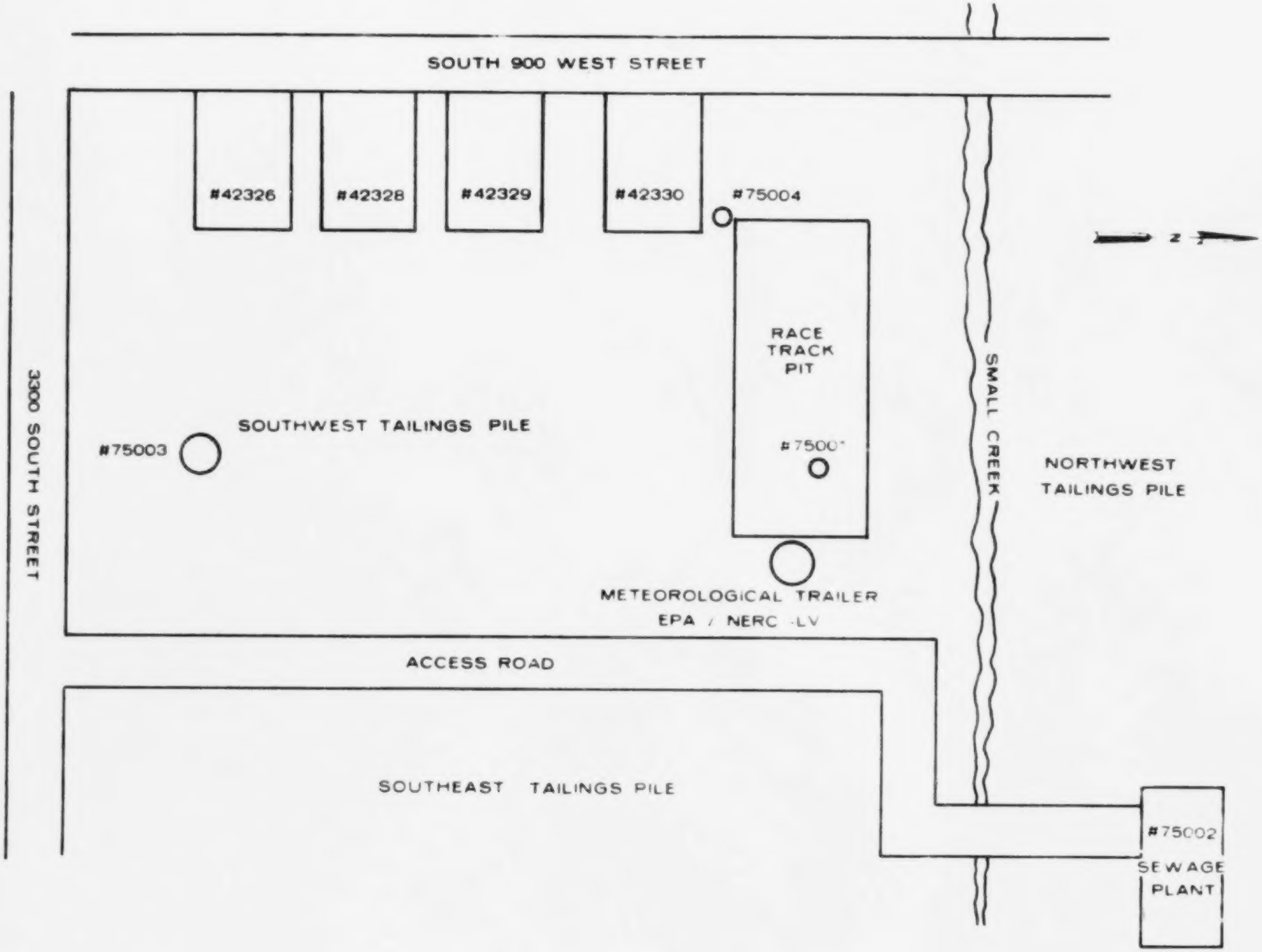

SOUTH 900 WEST STREET
#42326
#42328
#42329
#42330
#75004
N
RACE TRACK PIT
#75001
SMALL CREEK
3300 SOUTH STREET
#75003
SOUTHWEST TAILINGS PILE
NORTHWEST TAILINGS PILE
METEOROLOGICAL TRAILER
EPA / NERC -LV
ACCESS ROAD
SOUTHEAST TAILINGS PILE
#75002
SEWAGE PLANT

Figure 22. Air Sampling Locations - May 1973 - Salt Lake City, Utah

#75002, #75003, and #75004. A "grab" radon sample was collected for five minutes by drawing filtered air into an evacuated glass flask (2-liter volume) at locations #75001, #75002, #42326, #42328, #42329, and #42330. Simultaneously with the radon grab sample, short-lived radon progeny concentrations were determined by collecting a five-minute particulate air sample. The working level exposure was then determined by using the Thomas equations for the modified Tsivoglou method.

The results of the various air sampling methods for each of the locations are shown in tables V through XII and in figures 23 through 25.

Tables XIII and XIV show the comparisons between the various radon sampling methods for locations #75001 and #75002.

## DISCUSSION OF RESULTS

### Gamma Radiation Exposures on the Tailings Pile

The gamma radiation measurements which have been made on the pile are provided in table III and figures 5 through 8. The average TLD measurement for the 1967-68 on-pile sampling station was 1.1 mR/h. A grid system was established in 1970 with 13 stations from west to east, which were about 150 feet apart; 13 stations were also established from north to south, which were about 250 feet apart (figure 8). E-500B measurements were taken at each grid intersection and TLD's were placed at alternating grid intersections. As table XV shows, there is very good agreement between the TLD measurement (TLD mounted on a stake three feet above the surface) and the E-500B measurement (number in parentheses) at the same location; thus, the E-500B measurements do not require correction. The average for the northwest pile at the 12 locations where TLD and E-500B measurements were made (table XV) was 0.57 mR/h (TLD) and 0.53 mR/h (E-500B). The average of all 35 E-500B (three-foot) measurements (figure 7) was 0.63 mR/h. Similarly, the southwest pile (table XV) showed 1.1 mR/h (TLD) and 0.99 (E-500B) with a 1.12 mR/h for all 32 (three-foot) E-500B measurements (figure 6); and the southeast pile (table XV) had an average of 0.47 mR/h (TLD) and 0.45 mR/h (E-500B) with 0.45 mR/h for all 46 (three-foot) E-500B measurements (figure 5). Fulltime occupancy in these areas would result in whole body gamma exposures

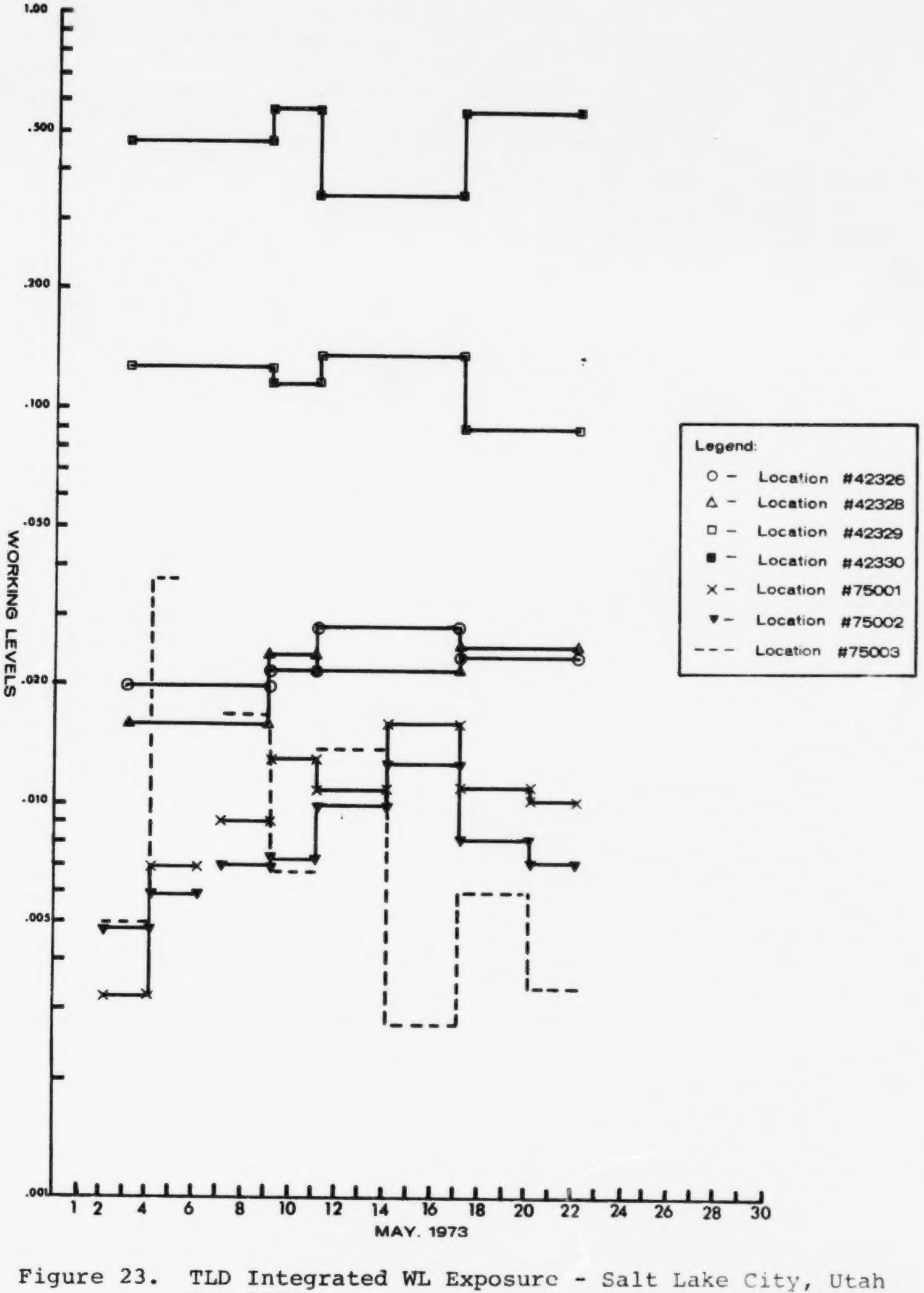


Figure 23. TLD Integrated WL Exposure - Salt Lake City, Utah May 1973

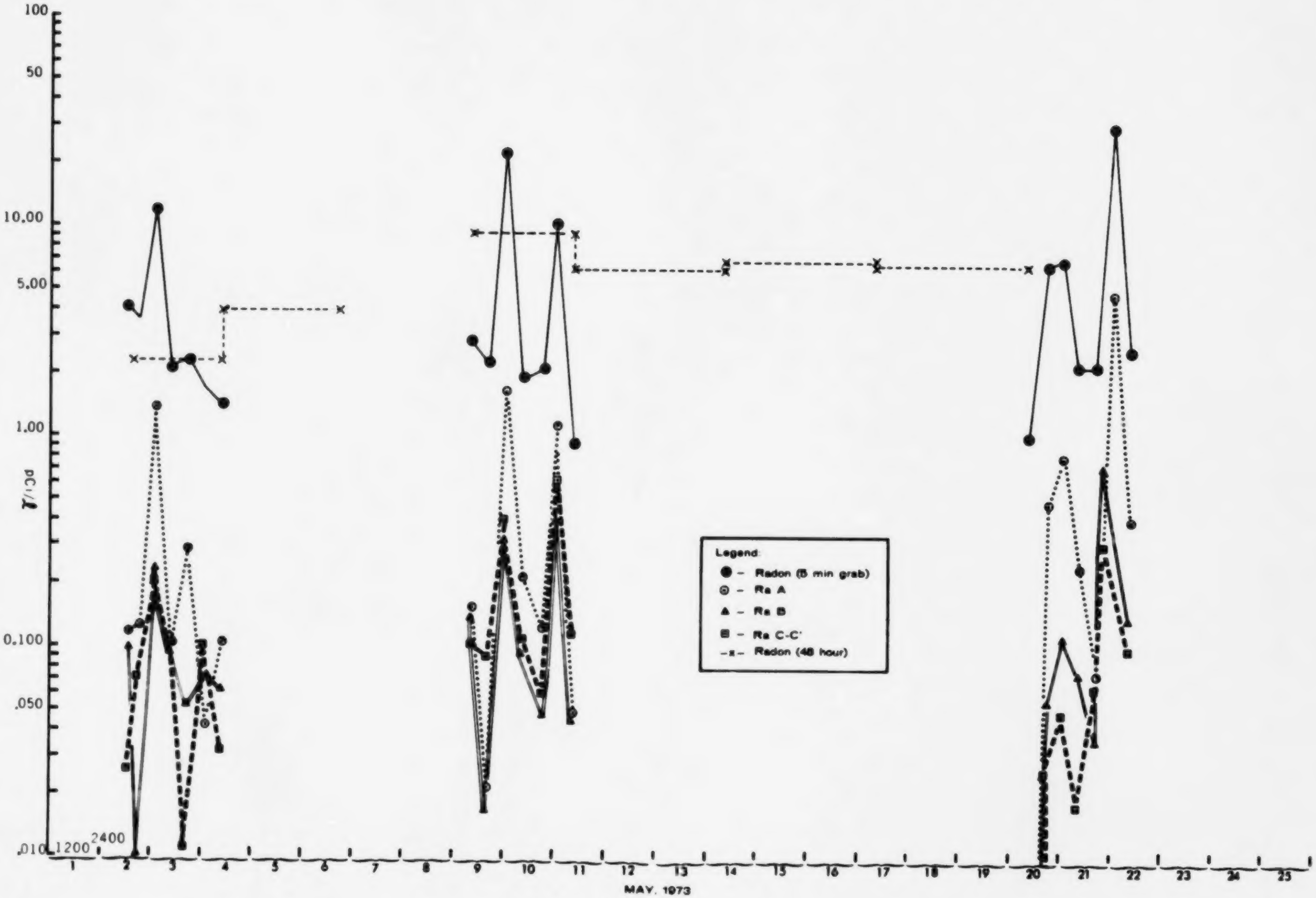


Figure 24. Radon and Radon Daughter Concentration (pCi/l) Salt Lake City, Utah (Location #75001) - May 1973

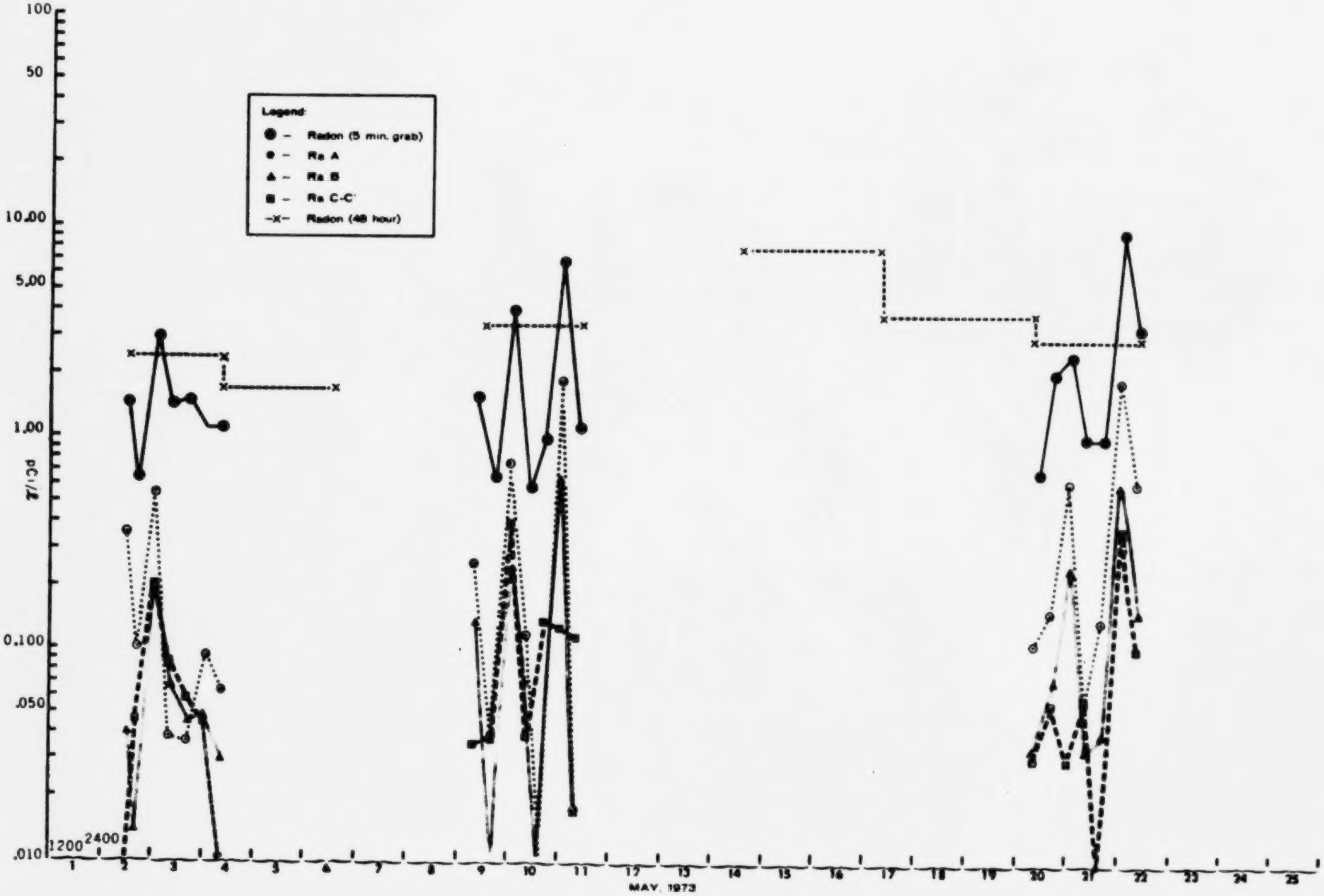


Figure 25. Radon and Radon Daughter Concentration (pCi/l) Salt Lake City, Utah (Location #75002) - May 1973

of about 100 times above background. The exposures received by children using the area as a playground are not beneficial and the exposures are received unknowingly.

## Radon and Radon Daughter Concentrations

Radium decays to radon, a chemically inert gas. Radon is capable of diffusing through most materials. The radon, in turn, decays to several short-lived particulate radon daughters (figure 3). When inhaled these particles can remain in the air pathways long enough for the alpha decay energy from the radon daughters, which represents the principal dose received, to be absorbed by the cells lining the tracheobronchial passages.

The biological effect of excess exposure to radon daughters can be a form of lung cancer, considered to be 100 percent fatal. It is, therefore, unfortunate that there is only a limited amount of experimental evidence or clinical documentation available regarding the consequence of chronic low-level exposures.

During the 1967-1968 PHS Study, only radon measurements were made to determine if the Vitro uranium mill pile had any effect on the surrounding community. The guidance used for comparison of the sample values is found in 10CFR20. (5) This guidance states that at the perimeter of a site the radon concentration should not be above 3 pCi/l ($3 \times 10^{-9}$ μCi/ml); except, if a significant population group can be exposed, it should not exceed 1 pCi/l. Since measured community values did not exceed 1 pCi $^{222}$Rn/l, nothing more was done at that time. This is because of the mechanics of the WL. (If radon is in equilibrium with its daughters and 100 pCi/l of radon is present, the decay energy of the daughters will produce $1.3 \times 10^5$ MeV of alpha energy or one WL.) Thus, the less than 1 pCi/l radon measurements obtained (in the surrounding community) indicated that less than 0.01 WL would be present. Actually, a much lower WL would be present since radon would not be in equilibrium with its daughters because of the constant air movement. The presence of less than 1 pCi/l of radon led to the conclusion presented in DER 69-1 that there was no hazard created in the surrounding community (beyond one-half mile). Field data collected to date indicates that for general public areas (at distances greater than one-half mile from the tailings pile) the measured radon levels from the pile were not distinguishable from natural background levels and were found to be within current guides.

There is, at present, no general guidance for public exposures to radon or radon daughters. In general, an applicable occupational exposure guide is divided by ten to obtain an exposure guide applicable to an individual in the general population. The current occupational limit for uranium miners is 0.3 working level months (WLM) or four WLM per year. (If a person works in an atmosphere containing 0.3 WL for one working month, 170 hours, he has received 0.3 WLM.)

Because of the previous practice of using uranium mill tailings in the construction of homes, the Surgeon General of the USPHS was requested to furnish guidance to the State of Colorado. This guidance, which includes guidance for exposure to gamma radiation as well as radon daughters, was provided in August 1970. The working level value, 0.05 WL, is based on the time necessary (50y) for a person, continually in that atmosphere, to accumulate 120 WLM which is considered to be the dose necessary to double one's risk of contracting lung cancer; however, because of the many uncertainties and unknowns, the 0.01 WL value is being used as a remedial action level. (6)

The radon and radon daughter measurements made at the Vitro site in May 1973 were made to determine if the surface of the pile could be developed and, at the same time, to prevent any increase in public exposure to ionizing radiation. In the case of the race track proposal, any public exposure to ionizing radiation is considered unacceptable by EPA because the exposure would be non-beneficial and it would be received unknowingly by persons attending the racing events.

The integrated radon measurement obtained (table IX) from May 2 to May 20, 1973, indicated an average of 5.9 pCi/l at the pile with an average WL of 0.010 (table V). Thus, the radon daughters had reached 16.9 percent of equilibrium* with the radon.

Five-minute radon and particulate filter samples were also collected and the WL calculated. These samples were collected over three 48-hour periods from May 2 to 4, May 9 to 11, and May 20 to 22, 1973. The average values for these periods appear in tables VI, VII, and VIII; and although the average radon concentration was 5.7 pCi/l, the average working level was 0.002 which indicated the radon daughters had reached only three percent of equilibrium. The five-minute grab sample allows one to obtain radon daughter to radon ratios, but the answer obtained is valid only for the five minutes during which the sample was collected. Thus, the integrated values (table IX) provide a better estimate of the WL exposure.

---

*100 pCi $^{222}$Rn/l in 100% equilibrium with the radon daughter products is equal to 1 WL.

In the open, on the surface of the pile, the measured working level was 0.010 WL. The average at the other two locations on the surface of the pile (locations #75003 and #75004), as shown in table V, was 0.006 WL and 0.008 WL, respectively. Thus, the gamma exposure rate existing on the surface of the pile is unacceptable for public exposure, but the less than 0.01 WL's detected in the open would not cause undue concern. However, if an enclosure of any type is placed on or against the surface of the pile, the results are very different, as shown in table V for locations #42326, #42328, #42329, and #42330.

In general, the radon concentration inside a building will come into equilibrium with the radon concentration that exists outside the building, but the longer air-residence time inside the building will cause the radon daughters and radon to have a higher percent equilibrium and hence a higher WL.

One five-minute grab air sample was obtained in each of the four business buildings adjoining the west side of the tailings piles. Integrated WL measurements were also made in the buildings from May 3 to 22, 1973. The calculated percent equilibrium is higher for all of the buildings than the outside measurements and indicates the amount of ventilation present in the buildings at the time the grab sample was taken; i.e., there were no doors open in locations #42326 or #42328 but freight loading doors were open in locations #42329 and #42330.

The integrated WL's reported for the preceding four locations are 0.023 WL, 0.021 WL, 0.12 WL, and 0.47 WL, respectively. The yearly WL exposure would be estimated to be higher because during the cold months the buildings would not be open as much as during the warm months; i.e., May values.

The Suburban Sewage Treatment Plant is about one-quarter mile from the north edge of the tailings pile and the average integrated radon concentration was 3.67 pCi/l (table X), an average integrated WL (table V) of 0.008 WL, and 21.0 percent equilibrium. The grab sample values for the same period were 2.14 pCi/l radon, 0.001 WL, and 6.4 percent equilibrium (table VII). These values (table VII) appear to indicate what would be expected when compared to the values obtained in November 1970 (table IV). That is, the relative percent equilibrium is higher during November than during May indicating a longer air-residence time in November because the building is not open as much. Based on these values, an employee of the SSTP would not be expected to receive a working level overexposure during an eight-hour working day at the Suburban Sewage Treatment Plant.

## Gamma Radiation Exposures in the Salt Lake Valley

The mobile gamma scanning unit scanned 39,301 structures in the Salt Lake Valley and reported 272 gamma radiation anomalies. Twenty-seven of these were reported in Magna, Utah, but none were determined to be tailings locations. The remaining 245 anomalies were also investigated, resulting in the preparation of 226 Indoor Radon Study-Gamma Screening Forms, as shown in table XVI. (Fifteen locations were duplicated in the Mobile Gamma Scanning Unit Reports; two locations were screened which were not reported by the mobile unit; and six anomalies, previously surveyed in 1970, were reported by the mobile unit, but no screening form was completed. Also, two locations were duplicates, but two forms were filled out for each.) The location numbers assigned to the screening forms for the Salt Lake Valley are #42295 to #42476 and #42511 to #42554.

The causes of the anomalies (as listed in table XVIII) in the Salt Lake Valley are shown in table XIX. There are 64 anomalies reported in table XIX where nothing could be found or a refusal was obtained: 17 were bad address reports; seven were refusals; and at 40 locations, nothing could be detected on the property to indicate a reason for the reported anomaly. Fifteen anomalies were caused by radioactive materials, and 71 were determined to be tailings locations: 20 possible tailings use; 13 tailings away locations; 35 tailings under (up against) and away; two tailings under; and one was the Vitro uranium mill tailings pile. In addition, it was determined that at 36 of the 71 locations, the tailings were windblown from the tailings pile. It appeared that tailings had actually been hauled onto the property at the remaining 34 locations (excluding the tailings pile). Of these, 18 locations are tailings away and 16 locations are tailings under and away.

Radium dial clocks were found at Location #42410, a drug store. Associated gamma measurements were 50 µR/h.

At four locations, #42312, #42313, #42346, and #42411, the reported anomalies were determined to be due to "shine" from sources reported at another location, but not located on the involved property.

The gamma measurements obtained at the locations where natural radioactive materials were found are typical of the two-to-three times background measurements associated with comparable material.

Twenty locations were determined to be possible tailings use locations. All of the anomalies were apparently caused by windblown material from the tailings pile. Structures are involved at eight of the locations and the remaining locations (12) are vacant lots. Gamma measurements to 400 µR/h were recorded at these locations. These locations have a "4" recorded under "Use" on the screening forms and in the attached computer printouts (appendix D).

Thirteen properties designated by a "2" recorded under "Use" were determined to be tailings away (tailings more than ten feet from a habitable structure) locations. At four of the locations, #42309, #42319, #42335, and #42413, the tailings were found on property which contained structures. Seven involved vacant lots with gamma measurements to 1,000 µR/h and two were inactive tailings ponds at the Vitro mill site.

Thirty-six properties were determined to be tailings up against and away locations. At 16 of these, where the tailings material has apparently blown from the tailings pile onto the property and up against the structures, gamma measurements to 110 µR/h were recorded (#42301, #42302, #42304, #42305, #42306, #42307, #42315, #42316, #42317, #42318, #42347, #42349, #42350, #42352, #42355, and #42357). At the remaining 10 locations where similar measurements were obtained, the tailings material appeared to have been hauled onto the property (#42349, #42351, #42359, #42393, #42396, #42403, #42412, #42511, #42514, and #42546).

Tailings were determined to be under or under and away at six business locations. At Location #42311, with gamma measurements to 60 μR/h inside and 100 μR/h outside, the tailings are located under the floor slab. At Location #42329, with gamma measurements of 350 μR/h inside and 550 μR/h outside, the tailings were found over the entire property. At Location #42330, tailings were also found over the entire property; and gamma measurements of 500 μR/h inside and 2,500 μR/h outside were recorded. At Location #42363, where the entire floor slab is involved, 150 μR/h inside and 50 μR/h outside gamma measurements were recorded. Location #42394 is a Salt Lake City fire station with tailings over the entire area and gamma measurements recorded inside were 110 μR/h and 400 μR/h outside. At Location #42408, gamma measurements of 190 μR/h were observed in the display area with the associated outside measurements of 1,000 μR/h.

Three residential properties are tailings under locations. Location #42321 is a single family residence and the tailings were determined to be under the floor slab. The high inside gamma measurement (HIG) was made in the living room and 60 μR/h was recorded. Associated outside gamma measurements to 30 μR/h were recorded. At Location #42462, where tailings were found under the south section of a vacant trailer house, the associated gamma measurements were 100 μR/h. Gamma measurements to 130 μR/h were recorded in the utility room at Location #42528. Tailings were also found in the lawn and a flower bed with gamma measurements to 500 μR/h.

The screening form assigned Location #42295 was prepared for the former Vitro uranium mill site. The buildings at this site have been dismantled and removed since the time of the survey. There were no measurements obtained inside the mill buildings during the survey, but gamma measurements greater than 3,000 μR/h were obtained outside at the site.

In conclusion, there is not any one simple solution to the environmental problems associated with the radon emanations from uranium mill tailings. If the property now covered by the tailings is to be developed and structures placed on it, the stabilization will be very difficult and expensive. Various estimates have been made of the depth of soil necessary to significantly reduce radon emanation. (7) However, to date, there have been no attempts to cover tailings piles with sufficient material to eliminate or significantly reduce radon emanation. Removal of the tailings to another location would be a possible, but costly, solution. An estimate made for another site was $6 million to move one and one-half million tons 16 miles by truck (25¢/ton-mile mileage rate).

The EPA will continue to provide assistance to the State of Utah, subject to our resource limitations, to find a workable solution to the mineral tailings site problems.

## RECOMMENDATIONS

The exposures received by children and others using the tailings pile area as a playground or recreation area are not beneficial and the exposures are received unknowingly. The Vitro uranium mill site and tailings pile should be immediately fenced and locked to prevent all unauthorized access. This action will not only prevent radiation exposure, but will also prevent the possibility of any further use of the tailings material in construction.

As a result of various environmental studies in Salt Lake City and at the Vitro tailings piles, recommendations have been provided to the State of Utah by the PHS and EPA. In general, the recommendations have stated that all inactive uranium mill tailings piles should be temporarily stabilized by grading the surface and by covering the surface with "clean" material. This temporary stabilization is to prevent the migration of the tailings material into the surrounding environment by wind or water erosion. The temporary stabilization requires that routine maintenance of the cover be performed indefinitely or until a final solution is achieved.

After the community gamma survey reports were submitted to the State of Utah, the EPA provided general guidance to the State to utilize in determining if remedial action was desired for any surveyed locations. The EPA provided general guidance rather than a case-by-case interpretation because it is EPA's belief that the state agency responsible for radiation programs is in a much better position to weigh the various factors involved in the remedial action decision. In general, the EPA recommendations which are attached as appendix E are based on guidance submitted by the Surgeon General of the USPHS to the State of Colorado in August 1970 (appendix C). The Surgeon General's guidelines were developed to apply specifically to the situation in Grand Junction, Colorado. In the absence of any other available guidance at the present time, the application of this guidance to the Salt Lake City area may be used with limitations. The limitations must specifically address differences in site conditions, i.e., a case-by-case evaluation is absolutely necessary for the involved properties.

Subsequent to the May 1973 Study at the Vitro site, recommendations (appendix F) were provided by the EPA. These were presented to the Governor of the State of Utah on June 7, 1973. The EPA considered the following facts in preparing these recommendations:

1. The U.S. Atomic Energy Commission, in dealing with new uranium mill license applications, requires as a prerequisite to the issuance of a license, that the applicant submit its procedures for stabilization and long-term maintenance and control of tailings. Mill owners must also provide assurance that funds will be available for reclamation of the tailings area when mill activities are terminated. In addition, the AEC requires the licensee to subject the land on which the tailings are stored to the following restrictions:

a. The owner may not permit the exposure and release of the tailings material to the surrounding area.

b. No structures which men or animals can occupy may be built on the covered surface.

c. The covered surface may not be subdivided.

d. No private roads, trails, or rights of way may be established across the covered surface.

These restrictions are to be binding on the licensee while it owns the land, and on successive owners thereafter, for a period of 50 years or until such time prior to the expiration of the 50-year period as regulations are promulgated to control disposition of uranium mill tailings. (8)

2. The AEC has required one licensee of an inactive uranium mill to submit an Environmental Impact Statement (EIS) before the company's application for license termination is considered.

3. Because of the use of the uranium mill tailings in construction in Grand Junction, Colorado, the Congress of the United States authorized the expenditure of $5 million in Federal funds, matched by $1.6 million of State of Colorado

funds, to correct the overexposure to radiation occurring in that community. Tailings use in construction in Utah has also been determined, but the State has no regulations to control the further use of tailings. As evidenced by the construction work that has occurred on the surface of the Vitro tailings pile, unauthorized use of the tailings can still occur.

The EPA realizes that the AEC policy for new mill operators and the one EIS requirement for a uranium mill license termination would not be binding on the present owners of the inactive and delicensed Vitro facility; however, the EPA believes that the intent of these new policies should apply to proposals for new uses of land covered by a tailings pile or the land which is within one-half mile of a tailings pile.

Until regulations are available for the permanent control of the tailings, including, but not limited to, the first proposed use, any use of the tailings material or the tailings pile site and its immediate vicinity is not recommended.

The EPA further recommends that, because uranium mill tailings material has been found in the Salt Lake Valley, no new or remodeling construction be allowed at locations where tailings materials were found until a radiation survey of the site has been performed by a person or firm with competency in radiological health, as defined by the State's laws or statutes related to ionizing radiation. (Guidance levels that may be used for decontamination are discussed in appendix E.)

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Appendix E U.S. Environmental Protection Agency's Informal Guidance for Assessment of the Need for Remedial Action Based on the Follow-up Gamma Survey Reports for Communities which are Located near Uranium Mills 116

Appendix F U.S. Environmental Protection Agency's Recommendation for the Vitro Tailings Pile in Salt Lake City, Utah (June 7, 1973) 118

# APPENDIX A

## TABLES I - XIX

# TABLE I

### Concentrations of Radon 222 Found
### In 48-hour Integrated Air Samples
### From Salt Lake City, Utah
### ( 1967-1968 PHS Study)

| Station no. | Midpoint of sampling time |  | Concentration of radon 222 (pCi/liter) |  |  |  |
|---|---|---|---|---|---|---|
|  | hour | day | USAEC |  | SWRHL |  |
| 81 | 1458 | 10-31-67 | 18.3 ± 0.1 |  |  |  |
|  | 1035 | 11-7-67 | 17.6 ± 0.2 |  |  |  |
|  | 1115 | 11-28-67 |  |  | 16.66 |  |
|  | 1600 | 1-4-68 |  |  | 5.70 |  |
|  | 1100 | 1-16-68 | 4.24 ± 0.05 |  |  |  |
|  | 1330 | 2-14-68 |  |  | 9.69 |  |
|  | 1135 | 3-6-68 |  |  | 6.92 |  |
|  | 1030 | 3-20-68 |  |  | 1.62 |  |
|  | 1115 | 4-17-68 | 2.55 ± 0.05 |  |  |  |
|  | 1100 | 5-1-68 | 11.5 ± 0.1 |  |  |  |
|  | 1145 | 5-28-68 | 7.8 ± 0.1 |  |  |  |
|  | 1505 | 7-11-68 | 16.2 ± 0.1 | 17.5 ± 0.1 |  |  |
|  | 1052 | 7-31-68 | 7.44 ± 0.08 |  |  |  |
|  | 1050 | 8-21-68 | 5.67 ± 0.08 |  |  |  |
|  | 1240 | 9-11-68 |  |  | 5.11 |  |
|  | 1005 | 10-3-68 | 22.1 ± 0.2 | 21.8 ± 0.1 |  |  |
| 82 | 1245 | 10-27-67 | 5.9 ± 0.1 |  | 6.49 | 7.09 |
|  | 1115 | 11-16-67 | 5.1 ± 0.1 |  | 7.42 | 7.34 |
|  | 1025 | 12-27-67 | 4.4 ± 0.1 |  |  |  |
|  | 1120 | 12-5-67 |  |  | 2.26 |  |
|  | 1400 | 1-23-68 |  |  | 4.55 |  |
|  | 0740 | 2-7-68 |  |  | 3.49 | 4.39 |
|  | 1110 | 2-28-68 |  |  | 2.49 |  |
|  | 1035 | 3-20-68 |  |  | 4.38 |  |
|  | 1050 | 5-7-68 | 4.17 ± 0.06 |  |  |  |
|  | 1115 | 4-9-68 |  |  | 2.97 |  |
|  | 1130 | 5-28-68 | 3.13 ± 0.08 |  |  |  |
|  | 1220 | 6-19-68 |  |  | 3.70 |  |
|  | 1100 | 7-24-68 | 6.39 ± 0.09 |  |  |  |
|  | 1205 | 8-7-68 |  |  | 5.20 |  |
|  | 1105 | 9-5-68 |  |  | 3.07 |  |
| 83 | 0830 | 11-1-67 |  |  | 1.30 |  |
|  | 1035 | 11-21-67 | 0.39 ± 0.03 |  |  |  |
|  | 1115 | 12-12-67 |  |  | 0.50 |  |
|  | 1415 | 1-11-68 | 0.50 ± 0.02 |  | 0.26 |  |
|  | 1250 | 1-30-68 |  |  | 0.12 |  |
|  | 1340 | 2-20-68 |  |  | 0.39 |  |
|  | 1120 | 3-13-68 | 0.30 ± 0.02 |  |  |  |
|  | 1105 | 4-3-68 | 0.31 ± 0.02 |  |  |  |
|  | 1010 | 4-24-68 | 0.21 ± 0.01 |  |  |  |
|  | 1145 | 5-14-68 | 0.17 ± 0.01 |  |  |  |

## TABLE I (CONT)

| Station no. | Midpoint of sampling time | | Concentration of radon 222 (pCi/liter) | | | |
|---|---|---|---|---|---|---|
| | hour | day | USAEC | | SWRHL | |
| 83 | 1140 | 6-5-68 | | | 0.63 | |
| | 1125 | 6-25-68 | | | 0.48 | |
| | 1000 | 7-18-68 | | | 0.60 | |
| | 1110 | 8-14-68 | | | 0.42 | |
| | 1100 | 8-28-68 | 0.71 ± 0.03 | | | |
| | 1530 | 9-18-68 | | | 0.09 | |
| 84 | 1200 | 10-29-67 | | | 0.76 | |
| | 1040 | 11-28-67 | 0.44 ± 0.02 | | 0.38 | |
| | 1100 | 11-7-67 | | | 0.23 | |
| | 0945 | 12-20-67 | 0.42 ± 0.03 | | | |
| | 1040 | 1-16-68 | | | 0.85 | |
| | 1125 | 3-6-68 | 0.21 ± 0.02 | | | |
| | 1045 | 3-20-68 | 0.25 ± 0.02 | | | |
| | 1140 | 4-17-68 | | | 0.27 | |
| | 1110 | 5-1-68 | | | 0.31 | |
| | 1125 | 5-21-68 | | | 0.43 | |
| | 1130 | 6-11-68 | 0.21 ± 0.01 | | | |
| | 1040 | 7-31-68 | | | 0.28 | |
| | 1110 | 8-21-68 | | | 0.24 | |
| | 1255 | 9-11-68 | | | 0.39 | |
| | 1235 | 9-25-68 | 0.68 ± 0.02 | 0.53 ± 0.02 | 0.60 | |
| | 1020 | 10-9-68 | | | 1.23 | 1.05 |
| 85 | 1122 | 10-29-67 | 0.60 ± 0.02 | | | |
| | 1050 | 11-16-67 | | | 0.63 | 0.58 |
| | 1130 | 12-5-67 | | | 0.36 | 0.33 |
| | 1155 | 1-23-68 | 0.98 ± 0.04 | | | |
| | 0755 | 2-7-68 | 0.83 ± 0.04 | 1.00 ± 0.04 | | |
| | 1135 | 3-6-68 | 0.23 ± 0.02 | | | |
| | 1015 | 3-27-68 | 0.58 ± 0.02 | | | |
| | 1100 | 4-9-68 | 0.81 ± 0.02 | | | |
| | 1030 | 5-7-68 | 0.82 ± 0.03 | | | |
| | 1120 | 5-28-68 | 0.47 ± 0.03 | | | |
| | 1055 | 6-19-68 | 0.51 ± 0.02 | | | |
| | 1150 | 7-24-68 | | | 0.62 | |
| | 1020 | 10-3-68 | 1.30 ± 0.03 | 1.44 ± 0.05 | 1.4 | |
| 86 | 1315 | 10-29-67 | | | 0.50 | |
| | 1045 | 11-21-67 | 0.44 ± 0.02 | | | |
| | 1125 | 12-12-67 | | | 0.15 | |
| | 1547 | 1-3-68 | 0.54 ± 0.03 | | | |

## TABLE I (CONT)

| Station no. | Midpoint of sampling time | | Concentration of radon 222 (pCi/liter) | | | |
|---|---|---|---|---|---|---|
| | hour | day | USAEC | | SWRHL | |
| 86 | 1305 | 1-30-68 | | | 0.11 | |
| | 1310 | 2-20-68 | 0.23 ± 0.01 | | | |
| | 1045 | 3-13-68 | | | 0.31 | |
| | 1120 | 4-3-68 | | | 0.28 | |
| | 1050 | 4-24-68 | | | 0.17 | |
| | 1100 | 5-21-68 | 0.30 ± 0.02 | | | |
| | 1130 | 6-5-68 | 0.15 ± 0.02 | 0.17 ± 0.01 | | |
| | 1110 | 6-25-68 | 0.29 ± 0.02 | | | |
| | 1030 | 7-18-68 | 0.51 ± 0.04 | | 0.32 | |
| | 1305 | 8-14-68 | | | 0.17 | |
| | 1100 | 8-28-68 | 0.20 ± 0.01 | 0.19 ± 0.02 | | |
| 91 | 1117 | 10-27-67 | 0.38 ± 0.02 | | | |
| | 1025 | 11-7-67 | | | 0.17 | |
| | 1105 | 11-28-67 | | | 0.99 | |
| | 1005 | 12-20-67 | | | 0.48 | 0.46 |
| | 1110 | 1-16-68 | 0.69 ± 0.04 | 0.73 ± 0.05 | | |
| | 1255 | 2-14-68 | | | 0.61 | |
| | 1155 | 3-6-68 | | | 0.27 | |
| | 1100 | 3-20-68 | | | 0.80 | |
| | 1045 | 4-17-68 | 0.18 ± 0.02 | 0.17 ± 0.01 | | |
| | 1040 | 5-1-68 | | | 0.24 | |
| | 1150 | 5-21-68 | | | 0.26 | |
| | 1125 | 6-11-68 | | | 0.24 | |
| | 1105 | 7-8-68 | 0.99 ± 0.04 | | | |
| | 1045 | 8-21-68 | | | 0.15 | |
| | 1220 | 9-11-68 | 0.22 ± 0.01 | 0.20 ± 0.02 | | |
| 92 | 1550 | 10-31-67 | | | 0.42 | |
| | 1025 | 11-14-67 | | | 0.82 | |
| | 1105 | 12-5-67 | 0.21 ± 0.01 | 0.26 ± 0.01 | | |
| | 1055 | 12-27-67 | | | 0.84 | |
| | 1415 | 1-23-68 | | | 0.85 | |
| | 1110 | 2-28-68 | | | 0.42 | |
| | 1100 | 3-27-68 | 0.26 ± 0.01 | | | |
| | 1020 | 4-9-68 | 0.23 ± 0.01 | | | |
| | 1120 | 5-7-68 | | | 0.29 | |
| | 1230 | 5-28-68 | | | 0.22 | |
| | 1215 | 6-19-68 | 0.40 ± 0.02 | | | |
| | 1130 | 8-7-68 | 0.30 ± 0.01 | 0.22 ± 0.02 | | |
| | 1150 | 9-5-68 | 0.40 ± 0.02 | 0.45 ± 0.03 | | |
| | 1530 | 9-18-68 | | | 0.17 | |
| | 0945 | 10-3-68 | | | 0.26 | |

## TABLE I (CONT)

| Station no. | Midpoint of sampling time |  | Concentration of radon 222 (pCi/liter) |  |  |
|---|---|---|---|---|---|
|  | hour | day | USAEC |  | SWRHL |
| 93 | 1450 | 10-31-67 | 0.55 ± 0.02 |  |  |
|  | 1045 | 12-12-67 | 0.25 ± 0.02 |  |  |
|  | 1335 | 1-11-68 | 0.25 ± 0.02 |  |  |
|  | 1335 | 1-30-68 | 0.19 ± 0.02 |  |  |
|  | 1335 | 2-20-68 | 0.16 ± 0.01 |  |  |
|  | 1115 | 3-13-68 |  |  | 0.22 |
|  | 1005 | 4-24-68 |  |  | 0.06 |
|  | 1100 | 4-3-68 |  |  | 0.25 |
|  | 1145 | 5-14-68 |  |  | 0.07 |
|  | 1120 | 6-5-68 |  |  | 0.20 |
|  | 1045 | 6-25-68 | 0.30 ± 0.02 |  |  |
|  | 1000 | 7-18-68 | 0.38 ± 0.02 | 0.42 ± 0.02 |  |
|  | 1115 | 7-31-68 | 0.20 ± 0.01 |  |  |
|  | 1045 | 8-28-68 |  |  | 0.26 |
|  | 0900 | 10-5-68 |  |  | 0.54 |
| 94 | 1427 | 10-27-67 | 0.58 ± 0.03 | 0.60 ± 0.02 |  |
|  | 1000 | 11-7-67 | 0.83 ± 0.03 | 0.95 ± 0.04 |  |
|  | 1122 | 11-28-67 | 0.57 ± 0.03 |  |  |
|  | 1010 | 1-16-68 |  |  | 0.94 |
|  | 1225 | 2-14-68 | 0.60 ± 0.03 |  |  |
|  | 1045 | 3-13-68 | 0.17 ± 0.02 |  |  |
|  | 1135 | 3-20-68 |  |  | 0.46 |
|  | 0945 | 4-17-68 |  |  | 0.13 |
|  | 1125 | 5-1-68 | 0.29 ± 0.02 |  |  |
|  | 1035 | 5-21-68 | 0.07 ± 0.01 |  |  |
|  | 1040 | 6-11-68 | 0.24 ± 0.01 |  |  |
|  | 1050 | 7-2-68 |  |  | 0.50 |
|  | 1025 | 7-31-68 |  |  | 0.37 |
|  | 1000 | 8-21-68 | 0.14 ± 0.01 | 0.12 ± 0.02 |  |
|  | 1235 | 9-11-68 | 0.24 ± 0.01 | 0.29 ± 0.02 |  |
|  | 1200 | 9-25-68 | 0.69 ± 0.02 | 0.71 ± 0.03 |  |
|  | 1000 | 10-9-68 | 0.55 ± 0.03 | 0.57 ± 0.03 |  |
| 95 | 1000 | 11-14-67 | 0.52 ± 0.02 |  |  |
|  | 1047 | 12-5-67 | 0.20 ± 0.01 |  |  |
|  | 1055 | 1-23-68 | 0.58 ± 0.03 |  |  |
|  | 0825 | 2-7-68 | 0.58 ± 0.03 |  |  |
|  | 1130 | 2-28-68 | 0.32 ± 0.02 |  |  |
|  | 1015 | 3-20-68 |  |  | 0.17 |
|  | 1050 | 4-9-68 |  |  | 0.22 |
|  | 1040 | 5-7-68 |  |  | 0.19 |

TABLE I (CONT)

| Station no. | Midpoint of sampling time | | Concentration of radon 222 (pCi/liter) | | | |
|---|---|---|---|---|---|---|
| | hour | day | USAEC | | SWRHL | |
| 95 | 1120 | 5-28-68 | | | 0.21 | |
| | 1045 | 6-19-68 | | | 0.21 | |
| | 1350 | 7-11-68 | | | 0.20 | |
| | 1100 | 7-24-68 | | | 0.28 | |
| | 1205 | 8-7-68 | 0.20 ± 0.02 | 0.19 ± 0.01 | | |
| | 1300 | 8-14-68 | 0.10 ± 0.01 | 0.16 ± 0.04 | | |
| | 1030 | 8-28-68 | | | 0.21 | |
| | 1435 | 9-18-68 | 0.14 ± 0.01 | 0.16 ± 0.02 | | |
| 96 | 1417 | 10-29-67 | 0.16 ± 0.01 | | | |
| | 1045 | 11-21-67 | | | 0.15 | |
| | 1155 | 12-12-67 | 0.17 ± 0.02 | | | |
| | 1200 | 1-7-68 | | | 0.45 | |
| | 1400 | 1-30-68 | 0.12 ± 0.01 | | | |
| | 1320 | 2-20-68 | | | 0.21 | |
| | 1225 | 3-13-68 | 0.12 ± 0.01 | 0.12 ± 0.01 | | |
| | 1205 | 4-3-68 | 0.17 ± 0.01 | | | |
| | 1155 | 5-14-68 | 0.06 ± 0.01 | | | |
| | 1235 | 6-5-68 | 0.09 ± 0.01 | | | |
| | 1145 | 6-25-68 | | | 0.24 | |
| | 0915 | 7-18-68 | 0.22 ± 0.02 | 0.42 ± 0.03 | 0.38 | 0.31 |
| | 1200 | 8-14-68 | 0.25 ± 0.02 | | | |
| | 1525 | 9-25-68 | | | 0.44 | |
| | 2230 | 10-8-68 | 0.28 ± 0.02 | 0.27 ± 0.02 | | |

Location of radon sampling stations in Salt Lake City, Utah:

| | |
|---|---|
| 81 | Center of tailings (700 West 3300 South). |
| 82 | Sewage Plant, 650 West 3300 South. |
| 83 | American Smelting & Refining Company, Hygiene & Research Department, 3422 South 7th West. |
| 84 | D. B. Harmon, 1080 West 3300 South. |
| 85 | Bonneville News Company, 965 Beardsley Place. |
| 86 | J. A. Skogg, 1501 West Claybourne Avenue. |
| 91 | D. Bolton, 570 West 3740 South. |
| 92 | Chris Body and Paint Shop Inc., 3152 South 2d West. |
| 93 | Tuloma Gas Products Co., 201 West 27th South. |
| 94 | Aluminum Manufacturing & Supply Co., 1809 South 8th West. |
| 95 | A. H. Higham, 105 Westwood Avenue. |
| 96 | Salt Lake City Health Department, 610 South 2d East. |

## TABLE II

## AVERAGE CONCENTRATIONS OF RADON 222 FOR SALT LAKE CITY, UTAH (1967-1968 PHS Study)

| Station and location | Number of samples | Concentration of radon 222 (pCi/liter) | | |
|---|---|---|---|---|
| | | Average | Standard deviation | Range |
| 81[a] | 16 | 10 | 6.4 | 1.6 - 22 |
| 82[b] | 15 | 4.2 | 1.4 | 2.3 - 6.6 |
| 83 | 16 | .43 | .31 | .09 - 1.3 |
| 84 | 15 | .39 | .24 | .21 - 1.1 |
| 85 | 13 | .68 | .30 | .23 - 1.4 |
| 86 | 13 | .28 | .14 | .11 - .54 |
| 91 | 15 | .44 | .30 | .15 - .99 |
| 92 | 14 | .42 | .24 | .17 - .85 |
| 93 | 14 | .24 | .12 | .06 - .55 |
| 94 | 17 | .44 | .26 | .07 - .94 |
| 95 | 17 | .29 | .16 | .13 - .60 |
| 96 | 16 | .22 | .12 | .06 - .45 |

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[a] Onpile stations.

[b] This station is not actually onpile, but adjacent to the pile at the sewage plant.

## TABLE III

## THERMOLUMINESCENT DOSIMETER RESULTS
(1967-1968 PHS Study)

| Location | Station | Net average exposure rate (mR/hour) |
|---|---|---|
| Salt Lake City, Utah (June 17 to July 17, 1968) | 81[a] | 1.1 |
| | 85 | .01 |
| | 86 | .01 |
| | 91 | .01 |
| | 96 | .01 |

[a] Onpile stations.

## TABLE IV
## AIR SAMPLING RESULTS

LOCATION: #75002 - SEWAGE TREATMENT PLANT (INDOOR)
SALT LAKE CITY, UTAH

YEAR: 1970

| DATE | TIME | COLLECTION PERIOD (MINUTE) | TIME INTEGRATED COUNTS PER MINUTE |  |  | C (dpm/cpm) | V l/min | W.L. | RADON DAUGHTER CONCENTRATIONS (pCi/l) |  |  | CONCENTRATION RATIOS |  | RADON pCi/l | EQUILIBRIUM RATIOS (RADON=1.0) |  |  | PERCENT EQUILIBRIUM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  | I(2-5) | I(6-20) | I(21-30) |  |  |  | Ra-A | Ra-B | Ra-C | B/A | C/A |  | A | B | C-C' |  |
| 11/3/70 | 1830 | 5 | (820) * | (578) | (603) | 1.22 | 30.4 | 0.02940 | 8.61 | 3.56 | 0.54 | 0.41 | 0.06 | N.S. | - | - | - | - |
| 11/5/70 | 1200 | 5 | (33) | (32) | (21) | 1.22 | 30.4 | 0.00070 | LT0.01 | 0.04 | 0.20 | - | - | 1.20 | 0.008 | 0.033 | 0.167 | 5.83 |
| 11/5/70 | 1400 | 5 | (59) | (35) | (32) | 1.22 | 30.4 | 0.00160 | 0.58 | 0.13 | 0.08 | 0.22 | 0.14 | 0.91 | 0.637 | 0.143 | 0.088 | 17.58 |
| 11/5/70 | 1600 | 5 | (29) | (25) | (23) | 1.22 | 30.4 | 0.00100 | 0.12 | 0.12 | 0.07 | 1.00 | 0.58 | 0.82 | 0.146 | 0.146 | 0.085 | 12.20 |
| 11/5/70 | 1700 | 5 | (41) | (20) | (24) | 1.22 | 30.4 | 0.00130 | 0.69 | 0.14 | LT0.01 | 0.20 | LT.01 | N.S. | - | - | - | - |
| 11/5/70 | 1800 | 5 | (177) | (121) | (110) | 1.22 | 30.4 | 0.00520 | 1.37 | 0.50 | 0.31 | 0.36 | 0.23 | 5.20 | 0.263 | 0.096 | 0.060 | 10.00 |
| 11/5/70 | 2330 | 5 | (60) | (36) | (31) | 1.22 | 30.4 | 0.00150 | 0.52 | 0.11 | 0.11 | 0.21 | 0.21 | N.S. | - | - | - | - |
| 11/6/70 | 0930 | 5 | (48) | (31) | (33) | 1.22 | 30.4 | 0.00160 | 0.58 | 0.19 | 0.02 | 0.33 | 0.03 | N.S. | - | - | - | - |
| 11/6/70 | 1130 | 5 | (46) | (42) | (42) | 1.22 | 30.4 | 0.00190 | 0.24 | 0.26 | 0.08 | 1.08 | 0.33 | N.S. | - | - | - | - |
|  |  |  |  |  |  | Average** |  | 0.00213 | 0.52 | 0.20 | 0.17 | - | - | 2.03 | 0.256 | 0.099 | 0.084 | 10.50 |

* Numbers in parentheses are counts per minute (obtained at five minutes, 15 minutes, and 30 minutes post collecting period).

**Only samples with Radon analysis included.

## TABLE V

## INTEGRATED WORKING LEVELS - SALT LAKE CITY, UTAH, SAMPLING STATIONS

| LOCATION | CORRECTED VOLUME (LITERS) | DATE START | DATE FINISH | OFF FLOW (LPM) | TIME (HOURS) | WORKING LEVELS | | COMBINED WORKING LEVEL | TOTAL TIME | TOTAL WORKING LEVELS | NO. OF SAM. | AVERAGE WORKING LEVEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 42326-01 | 18287 | 5/ 3/73 | 5/ 9/73 | 2.2 | 146.3 | .01971 | | | | | | |
| 42326-02 | 6155 | 5/ 9/73 | 5/11/73 | 2.5 | 48.3 | .02110 | | | | | | |
| 42326-03 | 17812 | 5/11/73 | 5/17/73 | 2.5 | 142.5 | .02743 | | | | | | |
| 42326-04 | 15395 | 5/17/73 | 5/22/73 | 2.5 | 120.8 | .02313 | | | 457.9 | .09137 | 4 | .0228 |
| 42328-01 | 18287 | 5/ 3/73 | 5/ 9/73 | 2.2 | 146.3 | .01594 | | | | | | |
| 42328-02 | 6312 | 5/ 9/73 | 5/11/73 | 2.6 | 47.7 | .02370 | | | | | | |
| 42328-03 | 17439 | 5/11/73 | 5/17/73 | 2.3 | 142.3 | .02143 | | | | | | |
| 42328-04 | 16065 | 5/17/73 | 5/22/73 | 2.5 | 121.4 | .02470 | | | 457.7 | .08577 | 4 | .0214 |
| 42329-01 | 18632 | 5/ 3/73 | 5/ 9/73 | 2.3 | 146.2 | .12817 | | | | | | |
| 42329-02 | 5858 | 5/ 9/73 | 5/11/73 | 2.4 | 47.8 | .11420 | | | | | | |
| 42329-03 | 17079 | 5/11/73 | 5/17/73 | 2.3 | 142.2 | .13370 | | | | | | |
| 42329-04 | 12757 | 5/17/73 | 5/22/73 | 2.5 | 104.1 | .08768 | | | 440.3 | .46375 | 4 | .1159 |
| 42330-01 | 19704 | 5/ 3/73 | 5/ 9/73 | 2.5 | 146.2 | .46676 | | | | | | |
| 42330-02 | 2131 | 5/ 9/73 | 5/11/73 | 0.0 | 28.0 | .56602 | NV-1 | | | | | |
| 42330-03 | 19165 | 5/11/73 | 5/17/73 | 2.5 | 142.2 | .38304 | | | | | | |
| 42330-04 | 16969 | 5/17/73 | 5/22/73 | 2.7 | 121.5 | .55888 | | | 409.9 | 1.40869 | 3 | .4696 |
| 75001-01 | 3954 | 5/ 2/73 | 5/ 4/73 | 2.9 | 26.9 | .00352 | | | | | | |
| 75001-02 | 7643 | 5/ 4/73 | 5/ 6/73 | 2.7 | 55.7 | .00684 | | | | | | |
| 75001-03 | 6885 | 5/ 7/73 | 5/ 9/73 | 2.7 | 49.3 | .00903 | | | | | | |
| 75001-04 | 6760 | 5/ 9/73 | 5/11/73 | 2.8 | 48.4 | .01293 | | | | | | |
| 75001-05 | 10182 | 5/11/73 | 5/14/73 | 2.7 | 74.2 | .01086 | | | | | | |
| 75001-06 | 9515 | 5/14/73 | 5/17/73 | 2.6 | 71.9 | .01599 | | | | | | |
| 75001-07 | 10027 | 5/17/73 | 5/20/73 | 2.6 | 74.4 | .01081 | | | | | | |
| 75001-08 | 6550 | 5/20/73 | 5/22/73 | 2.7 | 48.6 | .01021 | | | 449.4 | .08019 | 8 | .0100 |
| 75002-01 | 6030 | 5/ 2/73 | 5/ 4/73 | 2.6 | 44.0 | .00474 | | | | | | |
| 75002-02 | 7224 | 5/ 4/73 | 5/ 6/73 | 2.7 | 53.6 | .00584 | | | | | | |
| 75002-03 | 6021 | 5/ 7/73 | 5/ 9/73 | 2.6 | 45.5 | .00691 | | | | | | |
| 75002-04 | 6930 | 5/ 9/73 | 5/11/73 | 2.7 | 50.5 | .00717 | | | | | | |
| 75002-05 | 9739 | 5/11/73 | 5/14/73 | 2.6 | 73.6 | .00972 | | | | | | |
| 75002-06 | 8871 | 5/14/73 | 5/17/73 | 2.5 | 68.3 | .01237 | | | | | | |
| 75002-07 | 9741 | 5/17/73 | 5/20/73 | 2.5 | 75.0 | .00805 | | | | | | |
| 75002-08 | 6240 | 5/20/73 | 5/22/73 | 2.7 | 46.3 | .00701 | | | 456.8 | .06180 | 8 | .0077 |
| 75003-01 | 2987 | 5/ 2/73 | 5/ 4/73 | 2.0 | 29.0 | .00499 | | | | | | |
| 75003-02A | 429 | 5/ 4/73 | 5/ 5/73 | 0.0 | 8.3 | .03666 | NV-1 | | | | | |
| 75003-02B | 306 | 5/ 6/73 | 5/ 6/73 | 2.5 | 2.5 | .00131 | | | | | | |
| 75003-03 | 1353 | 5/ 7/73 | 5/ 9/73 | 0.0 | 20.4 | .01679 | NV-1 | | | | | |
| 75003-04 | 6825 | 5/ 9/73 | 5/11/73 | 2.7 | 35.8 | .00675 | | | | | | |
| 75003-05 | 4925 | 5/11/73 | 5/14/73 | 1.2 | 50.2 | .01384 | | | | | | |
| 75003-06 | 4420 | 5/14/73 | 5/17/73 | 2.6 | 33.4 | .00272 | | | | | | |
| 75003-07 | 3824 | 5/17/73 | 5/20/73 | 2.6 | 28.9 | .00594 | | | | | | |
| 75003-08 | 2846 | 5/20/73 | 5/22/73 | 2.3 | 25.8 | .00376 | | | 205.6 | .03931 | 7 | .0056 |
| 75004-01 | 3687 | 5/ 2/73 | 5/ 4/73 | 2.3 | 32.0 | .00334 | | | | | | |
| 75004-02 | 940 | 5/ 4/73 | 5/ 5/73 | 0.0 | 15.3 | .01070 | NV-1 | | | | | |
| 75004-03 | 5331 | 5/ 9/73 | 5/11/73 | 2.3 | 43.5 | .00756 | | | | | | |
| 75004-04 | 8726 | 5/17/73 | 5/20/73 | 2.4 | 71.2 | .01090 | | | | | | |
| 75004-05 | 5417 | 5/20/73 | 5/22/73 | 2.5 | 44.2 | .00831 | | | 190.9 | .03011 | 4 | .0075 |

## TABLE VI

## AIR SAMPLING RESULTS

LOCATION: #75001 - TAILINGS PILE FLOOR OF PIT, SALT LAKE CITY, UTAH YEAR: 1973 PAGE 1 OF 3

| DATE | TIME | COLLECTION PERIOD (MINUTE) | TIME INTEGRATED COUNTS PER MINUTE | | | C | V | W.L. | RADON DAUGHTER CONCENTRATIONS (pCi/1) | | | CONCEN-TRATION RATIOS | | RADON pCi/1 | EQUILIBRIUM RATIOS (RADON=1.0) | | | PERCENT EQUILIBRIUM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | I(2-5) | I(6-20) | I(21-30) | (dpm/cpm) | 1/min | | Ra-A | Ra-B | Ra-C | B/A | C/A | | A | B | C-C′ | |
| 5/2/73 | 1500 | 5 | 61 | 226 | 145 | 1.22 | 30.84 | 0.00073 | 0.119 | 0.100 | 0.026 | 0.84 | 0.22 | 4.0 | 0.03 | 0.03 | 0.01 | 1.8 |
| 5/2/73 | 1910 | 5 | 80 | 215 | 93 | 1.22 | 31.10 | 0.00044 | 0.121 | 0.009 | 0.072 | 0.08 | 0.59 | 3.6 | 0.03 | 0.00 | 0.02 | 1.2 |
| 5/2/73 | 2200 | 5 | 236 | 645 | 321 | 1.22 | 30.46 | 0.00165 | 0.475 | 0.110 | 0.160 | 0.23 | 0.34 | N.S. | - | - | - | - |
| 5/3/73 | 0200 | 5 | 486 | 1153 | 592 | 1.22 | 30.08 | 0.00337 | 1.355 | 0.239 | 0.204 | 0.18 | 0.15 | 12.0 | 0.11 | 0.02 | 0.02 | 2.8 |
| 5/3/73 | 0600 | 5 | 190 | 547 | 281 | 1.22 | 31.36 | 0.00138 | 0.351 | 0.107 | 0.128 | 0.31 | 0.37 | N.S. | - | - | - | - |
| 5/3/73 | 1000 | 5 | 102 | 372 | 201 | 1.22 | 29.70 | 0.00096 | 0.095 | 0.096 | 0.102 | 1.01 | 1.08 | 2.2 | 0.04 | 0.04 | 0.05 | 4.4 |
| 5/3/73 | 1430 | 5 | 69 | 207 | 121 | 1.22 | 29.95 | 0.00065 | 0.165 | 0.072 | 0.031 | 0.43 | 0.19 | N.S. | - | - | - | - |
| 5/3/73 | 1745 | 5 | (21)* | (11) | (11) | 1.22 | 28.80 | 0.00062 | 0.292 | 0.053 | 0.011 | 0.18 | 0.04 | 2.3 | 0.13 | 0.02 | .00 | 2.7 |
| 5/3/73 | 2200 | 5 | 404 | 1069 | 559 | 1.22 | 28.75 | 0.00316 | 1.014 | 0.251 | 0.226 | 0.25 | 0.22 | N.S. | - | - | - | - |
| 5/4/73 | 0150 | 5 | 86 | 326 | 171 | 1.22 | 29.12 | 0.00081 | 0.044 | 0.075 | 0.102 | 1.71 | 2.33 | 1.7 | 0.03 | 0.04 | 0.06 | 4.8 |
| 5/4/73 | 0600 | 5 | 946 | 2293 | 1155 | 1.22 | 29.00 | 0.00669 | 2.577 | 0.446 | 0.475 | 0.17 | 0.18 | N.S. | - | - | - | - |
| 5/4/73 | 1010 | 5 | 55 | 182 | 106 | 1.22 | 29.24 | 0.00056 | 0.108 | 0.063 | 0.034 | 0.59 | 0.31 | 1.4 | 0.08 | 0.05 | 0.02 | 4.0 |
| 5/9/73 | 0930 | 5 | 118 | 431 | 244 | 1.22 | 28.14 | 0.00127 | 0.152 | 0.141 | 0.106 | 0.93 | 0.70 | 2.8 | 0.05 | 0.05 | 0.04 | 4.5 |
| 5/9/73 | 1306 | 5 | 59 | 186 | 99 | 1.22 | 24.46 | 0.00061 | 0.119 | 0.055 | 0.056 | 0.46 | 0.47 | N.S. | - | - | - | - |
| 5/9/73 | 1640 | 5 | 56 | 191 | 86 | 1.22 | 24.92 | 0.00045 | 0.023 | 0.017 | 0.090 | 0.77 | 3.99 | 2.2 | 0.01 | 0.01 | 0.04 | 2.0 |
| 5/9/73 | 2110 | 5 | 418 | 1136 | 581 | 1.22 | 30.17 | 0.00306 | 0.909 | 0.228 | 0.259 | 0.25 | 0.29 | N.S. | - | - | - | - |
| 5/10/73 | 0045 | 5 | 680 | 1765 | 886 | 1.22 | 29.40 | 0.00487 | 1.610 | 0.330 | 0.411 | 0.21 | 0.26 | 21.0 | 0.08 | 0.02 | 0.02 | 2.3 |

## TABLE VI (Cont.)

## AIR SAMPLING RESULTS

LOCATION: #75001 - TAILINGS PILE FLOOR OF PIT, SALT LAKE CITY, UTAH YEAR: 1973 OF 3

| DATE | TIME | COLLECTION PERIOD (MINUTE) | TIME INTEGRATED COUNTS PER MINUTE I(2-5) | II(6-20) | I(21-30) | C (dpm/cpm) | V l/min | W.L. | RADON DAUGHTER CONCENTRATIONS (pCi/l) Ra-A | Ra-B | Ra-C | CONCENTRATION RATIOS B/A | C/A | RADON pCi/l | EQUILIBRIUM RATIOS (RADON=1.0) A | B | C-C' | PERCENT EQUILIBRIUM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5/10/73 | 0445 | 5 | 5054 | 12121 | 6788 | 1.22 | 28.52 | 0.04169 | 16.502 | 3.836 | 1.403 | 0.23 | 0.09 | N.S. | - | - | - | - |
| 5/10/73 | 0920 | 5 | 123 | 387 | 202 | 1.22 | 27.00 | 0.00111 | 0.212 | 0.095 | 0.111 | 0.45 | 0.53 | 1.9 | 0.11 | 0.05 | 0.06 | 5.8 |
| 5/10/73 | 1230 | 5 | 65 | 204 | 100 | 1.22 | 28.08 | 0.00051 | 0.087 | 0.034 | 0.067 | 0.39 | 0.77 | N.S. | - | - | - | - |
| 5/10/73 | 1740 | 5 | 71 | 219 | 113 | 1.22 | 28.08 | 0.00060 | 0.121 | 0.049 | 0.061 | 0.40 | 0.51 | 2.1 | 0.06 | 0.02 | 0.03 | 2.9 |
| 5/10/73 | 2110 | 5 | 2498 | 5894 | 3288 | 1.22 | 28.30 | 0.02050 | 8.338 | 1.855 | 0.669 | 0.22 | 0.08 | N.S. | - | - | - | - |
| 5/11/73 | 0045 | 5 | 729 | 2216 | 1102 | 1.22 | 28.08 | 0.00579 | 1.165 | 0.406 | 0.679 | 0.35 | 0.58 | 9.8 | 0.12 | 0.04 | 0.07 | 5.4 |
| 5/11/73 | 0445 | 5 | 195 | 548 | 305 | 1.22 | 27.68 | 0.00178 | 0.513 | 0.173 | 0.102 | 0.34 | 0.20 | N.S. |  | - | - | - |
| 5/11/73 | 0853 | 5 | 91 | 317 | 152 | 1.22 | 28.52 | 0.00072 | 0.049 | 0.045 | 0.117 | 0.90 | 2.38 | 0.91 | 0.05 | 0.05 | 0.13 | 7.9 |
| 5/20/73 | 0950 | 5 | 39 | 133 | 56 | 1.22 | 27.64 | 0.00025 | 0.001 | 0.002 | 0.063 | 2.68 | 67.6 | 1.1 | LT.01 | LT.01 | 0.06 | 2.3 |
| 5/20/73 | 1330 | 5 | 52 | 167 | 93 | 1.22 | 28.19 | 0.00050 | 0.099 | 0.051 | 0.038 | 0.52 | 0.38 | N.S. | - | - | - | - |
| 5/20/73 | 1808 | 5 | (34) | (16) | (15) | 1.22 | 27.64 | 0.00090 | 0.495 | 0.057 | 0.026 | 0.12 | 0.05 | 6.6 | 0.08 | 0.01 | LT.01 | 1.4 |
| 5/20/73 | 2120 | 5 | 273 | 572 | 287 | 1.22 | 28.52 | 0.00184 | 0.917 | 0.113 | 0.087 | 0.12 | 0.09 | N.S. | - | - | - | - |
| 5/21/73 | 0038 | 5 | 226 | 462 | 242 | 1.22 | 28.30 | 0.00160 | 0.821 | 0.114 | 0.049 | 0.14 | 0.06 | 7.1 | 0.12 | 0.02 | 0.01 | 2.3 |
| 5/21/73 | 0520 | 5 | 245 | 474 | 239 | 1.22 | 26.83 | 0.00171 | 0.956 | 0.103 | 0.055 | 0.11 | 0.06 | N.S. |  | - | - | - |
| 5/21/73 | 0910 | 5 | 76 | 196 | 116 | 1.22 | 28.63 | 0.00070 | 0.245 | 0.075 | 0.018 | 0.30 | 0.07 | 2.2 | [illegible] | 0.01 | [illegible] | 3.2 |
| 5/21/73 | 1300 | 5 | (3) | (13) | (8) | 1.22 | 30.30 | 0.00037 | [illegible] | LT.001 | 0.079 | LT.01 | 0.69 | N.S. |  | - |  | - |
| 5/21/73 | 1710 | 5 | 62 | 201 | 100 | 1.22 | 28.14 | 0.00051 | 0.075 | 0.037 | 0.065 | 0.48 | 0.87 | 2.2 | [illegible] | 0.07 | [illegible] | 2.3 |

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## TABLE VI (Cont.)
## AIR SAMPLING RESULTS

LOCATION: #75001 - TAILINGS PILE FLOOR OF PIT, SALT LAKE CITY, UTAH YEAR: 1973 PAGE 3 OF 3

| DATE | TIME | COLLECTION PERIOD (MINUTE) | TIME INTEGRATED COUNTS PER MINUTE | | | C | V | W.L. | RADON DAUGHTER CONCENTRATIONS (pCi/1) | | | CONCENTRATION RATIOS | | RADON | EQUILIBRIUM RATIOS (RADON=1.0) | | | PERCENT EQUILIBRIUM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | I(2-5) | I(6-20) | I(21-30) | (dpm/cpm) | 1/min | | Ra-A | Ra-B | Ra-C | B/A | C/A | pCi/1 | A | B | C-C' | |
| 5/21/73 | 2104 | 5 | 237 | 581 | 314 | 1.22 | 28.30 | 0.00190 | 0.721 | 0.161 | 0.091 | 0.22 | 0.13 | N.S. | - | - | - | - |
| 5/22/73 | 0058 | 5 | 1387 | 2874 | 1516 | 1.22 | 28.36 | 0.00996 | 4.994 | 0.727 | 0.304 | 0.15 | 0.06 | 31.0 | 0.16 | 0.02 | 0.01 | 3.2 |
| 5/22/73 | 0513 | 5 | 1764 | 4132 | 2110 | 1.22 | 28.52 | 0.01274 | 5.246 | 0.881 | 0.768 | 0.17 | 0.15 | N.S. | - | - | - | - |
| 5/22/73 | 0920 | 5 | 174 | 495 | 270 | 1.22 | 28.91 | 0.00149 | 0.410 | 0.138 | 0.099 | 0.34 | 0.24 | 2.6 | 0.16 | 0.05 | 0.04 | 5.7 |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | AVERAGE** | | 0.00180 | 0.596 | 0.137 | 0.131 | - | - | 5.75 | 0.10 | 0.02 | 0.02 | 3.13 |

*Numbers in parentheses are counts per minute (obtained at five minutes, 15 minutes, and 30 minutes post collecting period).

**Only those samples with radon analysis included in average.

# TABLE VII

## AIR SAMPLING RESULTS

LOCATION: #75002 -- Sewage Treatment Plant, Salt Lake City, Utah YEAR: 1973 PAGE 1 OF 3

| DATE | TIME | COLLECTION PERIOD (MINUTE) | TIME INTEGRATED COUNTS PER MINUTE | | | C (dpm/cpm) | V l/min | W.L. | RADON DAUGHTER CONCENTRATIONS (pCi/l) | | | CONCEN-TRATION RATIOS | | RADON pCi/l | EQUILIBRIUM RATIOS (RADON=1.0) | | | PERCENT EQUILIBRIUM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | I(2-5) | I(6-20) | I(21-30) | | | | Ra-A | Ra-B | Ra-C | B/A | C/A | | A | B | C-C' | |
| 5/2/73 | 1330 | 5 | (23)* | (10) | (10) | 1.22 | 29.46 | 0.00058 | 0.355 | 0.039 | 0.005 | 0.11 | 0.01 | 1.4 | 0.25 | 0.03 | LT.01 | 4.1 |
| 5/2/73 | 1752 | 5 | 60 | 160 | 73 | 1.22 | 32.72 | 0.00034 | 0.100 | 0.013 | 0.045 | 0.13 | 0.45 | 0.65 | 0.15 | 0.02 | 0.07 | 5.2 |
| 5/2/73 | 2250 | 5 | 609 | 1190 | 633 | 1.22 | 30.20 | 0.00405 | 2.195 | 0.295 | 0.078 | 0.13 | 0.04 | NS | -- | -- | -- | -- |
| 5/3/73 | 0240 | 5 | 291 | 860 | 452 | 1.22 | 30.83 | 0.00226 | 0.541 | 0.191 | 0.196 | 0.35 | 0.36 | 3.0 | 0.18 | 0.06 | 0.07 | 7.5 |
| 5/3/73 | 0640 | 5 | 199 | 471 | 244 | 1.22 | 28.22 | 0.00149 | 0.601 | 0.109 | 0.085 | 0.18 | 0.14 | NS | -- | -- | -- | -- |
| 5/3/73 | 0944 | 5 | 74 | 280 | 147 | 1.22 | 29.57 | 0.00068 | 0.038 | 0.063 | 0.086 | 1.65 | 2.24 | 1.4 | 0.03 | 0.05 | 0.06 | 4.9 |
| 5/3/73 | 1510 | 5 | 41 | 133 | 65 | 1.22 | 31.21 | 0.00029 | 0.041 | 0.020 | 0.041 | 0.47 | 0.99 | NS | -- | -- | -- | -- |
| 5/3/73 | 1830 | 5 | 55 | 202 | 106 | 1.22 | 31.60 | 0.00047 | 0.036 | 0.043 | 0.057 | 1.18 | 1.57 | 1.5 | 0.02 | 0.03 | 0.04 | 3.1 |
| 5/3/73 | 2300 | 5 | 341 | 673 | 383 | 1.22 | 29.49 | 0.00253 | 1.328 | 0.221 | 0.010 | 0.17 | 0.01 | NS | -- | -- | -- | -- |
| 5/4/73 | 0240 | 5 | 58 | 187 | 101 | 1.22 | 30.37 | 0.00050 | 0.092 | 0.047 | 0.044 | 0.51 | 0.48 | 1.1 | 0.08 | 0.04 | 0.04 | 4.5 |
| 5/4/73 | 0600 | 5 | 591 | 1952 | 924 | 1.22 | 29.49 | 0.00456 | 0.809 | 0.328 | 0.552 | 0.41 | 0.68 | NS | -- | -- | -- | -- |
| 5/4/73 | 0930 | 5 | 25 | 76 | 46 | 1.22 | 30.64 | 0.00024 | 0.062 | 0.029 | 0.009 | 0.46 | 0.15 | 1.1 | 0.06 | 0.03 | 0.01 | 2.2 |
| 5/9/73 | 0845 | 5 | 96 | 301 | 186 | 1.22 | 28.69 | 0.00105 | 0.253 | 0.130 | 0.035 | 0.51 | 0.14 | 1.5 | 0.17 | 0.09 | 0.02 | 7.0 |
| 5/9/73 | 1343 | 5 | 34 | 114 | 58 | 1.22 | 28.72 | 0.00029 | 0.038 | 0.023 | 0.035 | 0.61 | 0.94 | NS | -- | -- | -- | -- |
| 5/9/73 | 1745 | 5 | 34 | 103 | 46 | 1.22 | 29.49 | 0.00022 | 0.036 | 0.007 | 0.038 | 0.21 | 1.07 | 0.64 | 0.06 | 0.01 | 0.06 | 3.4 |
| 5/9/73 | 2235 | 5 | 770 | 1786 | 1025 | 1.22 | 30.20 | 0.00609 | 2.547 | 0.584 | 0.134 | 0.23 | 0.05 | NS | -- | -- | -- | -- |
| 5/10/73 | 0130 | 5 | 451 | 1344 | 670 | 1.22 | 28.92 | 0.00346 | 0.755 | 0.243 | 0.389 | 0.32 | 0.52 | 3.8 | 0.20 | 0.06 | 0.10 | 9.1 |

## TABLE VII (Cont.)

## AIR SAMPLING RESULTS

LOCATION: #75002 -- Sewage Treatment Plant, Salt Lake City, Utah  YEAR: 1973  PAGE 2 OF 3

| DATE | TIME | COLLECTION PERIOD (MINUTE) | TIME INTEGRATED COUNTS PER MINUTE I(2-5) | I(6-20) | I(21-30) | C (dpm/cpm) | V l/min | W.L. | RADON DAUGHTER CONCENTRATIONS (pCi/l) Ra-A | Ra-B | Ra-C | CONCENTRATION RATIOS B/A | C/A | RADON pCi/l | EQUILIBRIUM RATIOS (RADON=1.0) A | B | C-C' | PERCENT EQUILIBRIUM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5/10/73 | 0525 | 5 | 1128 | 2947 | 1708 | 1.22 | 28.69 | 0.01013 | 3.454 | 1.042 | 0.343 | 0.30 | 0.10 | NS | -- | -- | -- | -- |
| 5/10/73 | 0950 | 5 | 59 | 196 | 114 | 1.22 | 28.72 | 0.00061 | 0.116 | 0.069 | 0.037 | 0.60 | 0.32 | 0.57 | 0.20 | 0.12 | 0.07 | 10.7 |
| 5/10/73 | 1340 | 5 | 25 | 103 | 58 | 1.22 | 28.46 | 0.00028 | 0.012 | 0.032 | 0.029 | 2.78 | 2.47 | NS | -- | -- | -- | -- |
| 5/10/73 | 1730 | 5 | (3) | (13) | (6) | 1.22 | 28.46 | 0.00006 | LT.001 | 0.003 | 0.137 | -- | -- | 0.99 | LT.01 | 0.00 | 0.14 | 0.61 |
| 5/10/73 | 2145 | 5 | 96 | 302 | 169 | 1.22 | 27.41 | 0.00095 | 0.202 | 0.098 | 0.067 | 0.48 | 0.33 | NS | -- | -- | -- | -- |
| 5/11/73 | 0135 | 5 | 582 | 1548 | 937 | 1.22 | 28.71 | 0.00559 | 1.869 | 0.630 | 0.126 | 0.34 | 0.07 | 6.7 | 0.28 | 0.09 | 0.02 | 6.6 |
| 5/11/73 | 0523 | 5 | 135 | 437 | 258 | 1.22 | 29.49 | 0.00137 | 0.288 | 0.158 | 0.072 | 0.55 | 0.25 | NS | -- | -- | -- | -- |
| 5/11/73 | 0930 | 5 | 60 | 250 | 112 | 1.22 | 29.46 | 0.00044 | LT.001 | 0.017 | 0.113 | -- | -- | 1.1 | LT.01 | 0.02 | 0.10 | 4.0 |
| 5/20/73 | 1040 | 5 | 49 | 142 | 77 | 1.22 | 29.25 | 0.00042 | 0.108 | 0.038 | 0.030 | 0.35 | 0.27 | 0.68 | 0.16 | 0.06 | 0.04 | 6.2 |
| 5/20/73 | 1247 | 5 | 21 | 91 | 53 | 1.22 | 26.41 | 0.00028 | 0.009 | 0.035 | 0.025 | 3.91 | 2.86 | NS | -- | -- | -- | -- |
| 5/20/73 | 1725 | 5 | 62 | 212 | 118 | 1.22 | 26.03 | 0.00067 | 0.105 | 0.070 | 0.056 | 0.67 | 0.54 | 2.0 | 0.05 | 0.04 | 0.03 | 3.4 |
| 5/20/73 | 2205 | 5 | 169 | 435 | 271 | 1.22 | 28.49 | 0.00167 | 0.594 | 0.195 | 0.018 | 0.33 | 0.03 | NS | -- | -- | -- | -- |
| 5/21/73 | 0055 | 5 | 173 | 483 | 303 | 1.22 | 25.92 | 0.00199 | 0.616 | 0.242 | 0.034 | 0.39 | 0.05 | 2.5 | 0.25 | 0.10 | 0.01 | 8.0 |
| 5/21/73 | 0530 | 5 | 331 | 719 | 395 | 1.22 | 25.35 | 0.00286 | 1.326 | 0.240 | 0.074 | 0.18 | 0.06 | NS | -- | -- | -- | -- |
| 5/21/73 | 0900 | 5 | 52 | 173 | 86 | 1.22 | 26.66 | 0.00045 | 0.058 | 0.033 | 0.061 | 0.57 | 1.06 | 1.0 | 0.06 | 0.03 | 0.06 | 4.5 |
| 5/21/73 | 1345 | 5 | 24 | 91 | 51 | 1.22 | 26.30 | 0.00028 | 0.025 | 0.031 | 0.026 | 1.21 | 1.03 | NS | -- | -- | -- | -- |
| 5/21/73 | 1630 | 5 | 24 | 51 | 37 | 1.22 | 24.84 | 0.00029 | 0.135 | 0.039 | LT.00 | 0.29 | LT.01 | 1.0 | 0.14 | 0.04 | LT.01 | 2.9 |

## TABLE VII (Cont.)
## AIR SAMPLING RESULTS

LOCATION: #75002 -- Sewage Treatment Plant, Salt Lake City, Utah YEAR: 1973 PAGE 3 OF 3

| DATE | TIME | COLLECTION PERIOD (MINUTE) | TIME INTEGRATED COUNTS PER MINUTE | | | C | V | W.L. | RADON DAUGHTER CONCENTRATIONS (pCi/l) | | | CONCENTRATION RATIOS | | RADON | EQUILIBRIUM RATIOS (RADON=1.0) | | | PERCENT EQUILIBRIUM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | I(2-5) | I(6-20) | I(21-30) | (dpm/cpm) | l/min | | Ra-A | Ra-B | Ra-C | B/A | C/A | pCi/l | A | B | C-C' | |
| 5/21/73 | 2150 | 5 | 91 | 237 | 119 | 1.22 | 24.79 | 0.00077 | 0.254 | 0.053 | 0.066 | 0.21 | 0.26 | NS | -- | -- | -- | -- |
| 5/22/73 | 0110 | 5 | 654 | 1835 | 1013 | 1.22 | 25.35 | 0.00645 | 1.853 | 0.612 | 0.386 | 0.33 | 0.21 | 9.2 | 0.20 | 0.07 | 0.04 | 7.0 |
| 5/22/73 | 0523 | 5 | 1398 | 3673 | 2071 | 1.22 | 24.32 | 0.01430 | 4.788 | 1.390 | 0.623 | 0.29 | 0.13 | NS | -- | -- | -- | -- |
| 5/22/73 | 0850 | 5 | 180 | 461 | 247 | 1.22 | 23.65 | 0.00174 | 0.606 | 0.147 | 0.100 | 0.24 | 0.17 | 3.2 | 0.19 | 0.05 | 0.03 | 5.4 |
| AVERAGE | ** | | | | | | | 0.00136 | 0.368 | 0.129 | 0.095 | | | 2.14 | 0.17 | 0.06 | 0.04 | 6.36 |

* Numbers in parentheses are counts per minute (obtained at five minutes, 15 minutes, and 30 minutes post collecting period).

** Only samples with radon analysis included.

# TABLE VIII

## AIR SAMPLING RESULTS

LOCATION: BUSINESS BUILDINGS (INDOOR) SALT LAKE CITY, UTAH (#42326, 42328, 42329 and 42330, Respectively) YEAR: 1973

| DATE | TIME | COLLECTION PERIOD (MINUTE) | TIME INTEGRATED COUNTS PER MINUTE |  |  | C | V | W.L. | RADON DAUGHTER CONCENTRATIONS (pCi/1) |  |  | CONCENTRATION RATIOS |  | RADON pCi/1 | EQUILIBRIUM RATIOS (RADON=1.0) |  |  | PERCENT EQUILIBRIUM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  | I(2-5) | I(6-20) | I(21-30) | (dpm/cpm) | l/min |  | Ra-A | Ra-B | Ra-C | B/A | C/A |  | A | B | C-C' |  |
| 5/21/73 | 1010 | 5 | 707 | 2505 | 1366 | 1.22 | 26.03 | 0.00760 | 0.931 | 0.765 | 0.739 | 0.82 | 0.79 | 3.0 | 0.31 | 0.25 | 0.25 | 25.3 |
| 5/21/73 | 1115 | 5 | 850 | 3017 | 1688 | 1.22 | 27.64 | 0.00896 | 1.191 | 0.960 | 0.768 | 0.81 | 0.64 | 4.1 | 0.29 | 0.23 | 0.19 | 21.9 |
| 5/21/73 | 1035 | 5 | 203 | 655 | 398 | 1.24 | 27.41 | 0.00234 | 0.517 | 0.285 | 0.098 | 0.55 | 0.19 | 1.6 | 0.32 | 0.18 | 0.06 | 14.6 |
| 5/21/73 | 1045 | 5 | 1264 | 3199 | 1817 | 1.22 | 26.66 | 0.01168 | 4.210 | 1.136 | 0.424 | 0.27 | 0.10 | 18.0 | 0.23 | 0.06 | 0.02 | 6.5 |

## TABLE IX

### INTEGRATING RADON AIR SAMPLING RESULTS
### SALT LAKE CITY, UTAH

LOCATION: #75001 - TAILINGS PILE FLOOR OF PIT YEAR: 1973

| DATE/TIME | "ON" | DATE/TIME | "OFF" | MEASURED RADON IN pCi/l |
|---|---|---|---|---|
| 5/2/73 | 1500 | 5/4/73 | 1010 | 2.3 |
| 5/4/73 | 1015 | 5/6/73 | 1605 | 4.1 |
| 5/7/73 | 0830 | 5/9/73 | 0947 | No Sample |
| 5/9/73 | 1000 | 5/11/73 | 0910 | 9.3 |
| 5/11/73 | 0920 | 5/14/73 | 0915 | 6.3 |
| 5/14/73 | 1110 | 5/17/73 | 0720 | 6.8 |
| 5/17/73 | 0915 | 5/20/73 | 0750 | 6.6 |
| 5/20/73 | - | 5/22/73 | - | No Sample |
| | | | Average | 5.9 |

## TABLE X

### INTEGRATING RADON AIR SAMPLING RESULTS
### SALT LAKE CITY, UTAH

LOCATION: #75002 - SEWAGE TREATMENT PLANT YEAR: 1973

| DATE/TIME | "ON" | DATE/TIME | "OFF" | MEASURED RADON IN pCi/l |
|---|---|---|---|---|
| 5/2/73 | 1330 | 5/4/73 | 0930 | 2.4 |
| 5/4/73 | 0930 | 5/6/73 | 1530 | 1.7 |
| 5/7/73 | 1010 | 5/9/73 | - | No Sample |
| 5/9/73 | 1300 | 5/11/73 | 0945 | 3.4 |
| 5/11/73 | 0955 | 5/14/73 | 1130 | No Sample |
| 5/14/73 | 1140 | 5/17/73 | 0745 | 7.8 |
| 5/17/73 | 0800 | 5/20/73 | 0730 | 3.8 |
| 5/20/73 | 1100 | 5/22/73 | 0900 | 2.9 |
| | | | Average | 3.67 |

## TABLE XI

### INTEGRATING RADON AIR SAMPLING RESULTS
### SALT LAKE CITY, UTAH

LOCATION: #75003 -- South Side of Tailings Pile YEAR: 1973

| DATE/TIME | "ON" | DATE/TIME | "OFF" | MEASURED RADON IN pCi/l |
|---|---|---|---|---|
| 5/2/73 | 1225 | 5/4/73 | 1100 | 2.1 |
| 5/5/73 | 1700 | 5/6/73 | 1550 | 4.1 |
| 5/9/73 | 1045 | 5/11/73 | 1012 | 6.1 |
| 5/11/73 | 1035 | 5/14/73 | 0950 | 3.8 |
| 5/14/73 | 1025 | 5/17/73 | 0710 | 6.5 |
| | | | AVERAGE: | 4.52 |

## TABLE XII

### INTEGRATING RADON AIR SAMPLING RESULTS
### SALT LAKE CITY, UTAH

LOCATION: #75004 -- West Side of Tailings Pile YEAR: 1973

| DATE/TIME | "ON" | DATE/TIME | "OFF" | MEASURED RADON IN pCi/l |
|---|---|---|---|---|
| 5/4/73 | 1015 | 5/6/73 | 1605 | 4.1 |
| 5/9/73 | 1100 | 5/11/73 | 1150 | 9.7 |
| 5/17/73 | 1400 | 5/22/73 | 1020 | 9.4 |
| | | | AVERAGE: | 7.73 |

## TABLE XIII

## RADON SAMPLING METHOD COMPARISON

LOCATION: #75001, SALT LAKE CITY, UTAH | DATE: May 1973

| SAMPLING DATE | | AVERAGE* RADON (pCi/l) | INTEGRATED** RADON (pCi/l) | AVERAGEΔ WORKING LEVEL | INTEGRATED† WORKING LEVEL | AVERAGE % EQUILIBRIUM (5 MINUTE SAMPLES) | AVERAGE % EQUILIBRIUM (INTEGRATED) |
|---|---|---|---|---|---|---|---|
| ON | OFF | | | | | | |
| 5/2/73 | 5/4/73 | 3.89 | 2.3 | 0.00107 | 0.00352 | 2.75 | 15.30 |
| 5/9/73 | 5/11/73 | 5.82 | 9.3 | 0.00212 | 0.01293 | 3.64 | 13.90 |
| 5/20/73 | 5/22/73 | 7.54 | NS | 0.00220 | 0.01021 | 2.92 | --- |
| AVERAGE: | | 5.75 | 5.8 | 0.00180 | 0.00889 | 3.10 | 14.60 |

* Average of 5 minute samples collected every eight hours during a 48-hour period.

** Rn pCi/l calculated for midpoint of collection during a 48-hour continuous sample.

Δ Average W.L. obtained from the calculated radon daughters (A, B, C-C′) concentrations.

† Measured with TLD air sampler.

## TABLE XIV

## RADON SAMPLING METHOD COMPARISON

LOCATION: #75002 , SALT LAKE CITY, UTAH DATE: May 1973

| SAMPLING DATE | | AVERAGE* RADON (pCi/l) | INTEGRATED** RADON (pCi/l) | AVERAGE∆ WORKING LEVEL | INTEGRATED† WORKING LEVEL | AVERAGE % EQUILIBRIUM (5 MINUTE SAMPLES) | AVERAGE % EQUILIBRIUM (INTEGRATED) |
|---|---|---|---|---|---|---|---|
| ON | OFF | | | | | | |
| 5/2/73 | 5/4/73 | 1.45 | 2.4 | 0.00072 | 0.00474 | 4.97 | 19.75 |
| 5/9/73 | 5/11/73 | 2.19 | 3.4 | 0.00163 | 0.00717 | 7.44 | 21.09 |
| 5/20/73 | 5/21/73 | 2.80 | 2.9 | 0.00172 | 0.00701 | 6.14 | 24.17 |
| AVERAGE: | | 2.15 | 2.9 | 0.00136 | 0.00631 | 6.18 | 21.67 |

* Average of 5 minute samples collected every eight hours during a 48-hour period.

** Rn pCi/l calculated for midpoint of collection during a 48-hour continuous sample.

∆ Average W.L. obtained from the calculated radon daughters (A, B, C-C') concentrations.

† Measured with TLD air sampler.

# TABLE XV

## COMPARISON OF TLD AND E500B GAMMA RADIATION EXPOSURE RATES
## VITRO URANIUM MILL TAILINGS PILE
## SALT LAKE CITY, UTAH

| NORTH TO SOUTH GRID | WEST TO EAST GRID | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 | 3 | 5 | 7 | 9 | 11 | 13 |
| 1 | 0.28* (0.25) | 0.34 (0.4) | 0.30 (0.2) | Suburban Sewage Treatment Plant | | | |
| 3 | 0.38 (0.30) | 1.58 (1.3) | 0.26 (0.2) | | | | |
| 5 | 1.01 (1.0) | 1.22 (1.1) | 0.35 (0.5) | | | | |
| 7 | 0.31 (0.30) | 0.39 (0.4) | 0.42 (0.4) | 0.35 (0.35) | 0.56 (0.5) | 0.05 (0.6) | 0.39 (0.3) |
| 9 | 0.46 (0.5) | 1.52 (1.2) | 2.24 (2.0) | 0.64 (0.7) | 0.41 (0.4) | | 0.12 (0.18) |
| 10 | | | | 0.60 (0.7) | | 0.30 (0.3) | |
| 11 | Business | 0.86 (0.8) | 0.80 (0.7) | 0.68 (0.6) | 0.82 (0.6) | 0.62 (0.6) | 0.58 (0.15) |
| 12 | Buildings | | | 0.80 (0.5) | 0.63 (0.6) | 0.29 (0.45) | 0.21 (0.15) |
| 13 | | 1.13 (0.95) | 0.69 (0.8) | | | | |

*All Measurements in mR/h
0.00 TLD mR/h
(0.00) E500B mR/h

## TABLE XVI

### COMMUNITY GAMMA SCANNING AND SCREENING RESULTS

| COMMUNITY | NUMBER OF STRUCTURES SCANNED | ANOMALIES REPORTED | ANOMALIES CHECKED | FIELD FORMS PREPARED | TAILINGS LOCATIONS | NON-TAILINGS LOCATIONS | ANOMALIES UNABLE TO SCREEN | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | REFUSAL | BAD ADDRESS | DUPLICATION |
| Salt Lake City | 39,301* | 245 | 247 | 226 | 71 | 131 | 7 | 17 | 15 |

*Total structures scanned in the Salt Lake Valley, including Magna, Utah.

## TABLE XVII

### COMPUTER CODES AND LOCATION NUMBERS USED

| STATE | | COUNTY | | CITY | | |
|---|---|---|---|---|---|---|
| NAME | CODE | NAME | CODE | NAME | CODE | LOCATION NUMBERS ASSIGNED |
| Utah | 43 | Salt Lake | 035 | Salt Lake City | 1904 | 42,295-42,476 and 42,511-42,554 |

## TABLE XVIII

## DETERMINED CAUSE OF REPORTED SCANNING ANOMALIES

## SALT LAKE CITY, UTAH

| NUMBER OF LOCATIONS | CAUSE IDENTIFICATION LETTER FOR TABLE IV | CAUSE OF ANOMALY/REMARKS |
|---|---|---|
| 40 | A | Unexplained - Nothing detected on property to indicate a reason for the reported anomaly. |
| 17 | B | Bad address - Unable to find the location reported by the mobile unit. |
| 7 | C | Refusal - Occupant and/or owner refused to allow the survey. |
| 1 | D | Radium dial instrument on property. |
| 4 | F | "Shine" from other reported anomaly. |
| 10 | G | Uranium ore on property. |
| 68 | I | Natural activity in brick walls or fireplace |
| 1 | K | Natural activity in fertilizer. |
| 3 | M | Natural activity in gravel and/or soil. |
| 2 | N | Natural activity in stucco walls. |
| 2 | O | Natural activity in concrete walls in highwa underpass. |
| 20 | P | Possible tailings use - Unable to make positive field identification. |
| (32)* | Q | Tailings on property - Windblown from tailings pile. |
| 13 | R | Tailings deposit on property - Greater than ten feet from a habitable structure. |

## SALT LAKE TABLE XVLII (CONT)

| NUMBER OF LOCATIONS | CAUSE IDENTIFICATION LETTER FOR TABLE IV | CAUSE OF ANOMALY/REMARKS |
|---|---|---|
| 37 | S | Tailings deposit on property - Under or within ten feet of a habitable structure. |
| 1 | T | Uranium mill tailings pile - Mill area screen. |

226 Total Screening Forms

*Not added into total - Windblown tailings locations are in both the possible and determined tailings use locations.

# TABLE XIX

## ANOMALY OCCURRENCE IN SURVEYED COMMUNITIES

| | | CAUSE OF ANOMALY FROM TABLE III | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | UNKNOWN | | | RADIOACTIVE SOURCE OR ORE | | | | | NATURAL RADIOACTIVITY | | | | | | | TAILINGS LOCATIONS | | | | |
| **UTAH COMMUNITY** | **FIELD FORMS PREPARED** | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T |
| Salt Lake City | 226 | 40 | 17 | 7 | 1 | | 4 | 10 | | 68 | | 1 | | 3 | 2 | 2 | 20 | | 13 | 37 | 1 |
| | | 64 | | | 15 | | | | | 76 | | | | | | | 71 | | | | |

# APPENDIX B

# MOBILE GAMMA SCANNING REPORT

# SALT LAKE VALLEY, UTAH

SUMMATION: MOBILE RADIATION SURVEY
Salt Lake City, Utah

SURVEY COMMENCEMENT DATE: April 5-11, 1972

CURRENT REPORT PERIOD: April 5-11, 1972

| | |
|---|---|
| Survey Days | 7.0 |
| Structures Surveyed | 3,871 |
| Radiation Anomalies | 88 |
| Miles Surveyed | 54.90 |

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CONTRACT NO. AT [illegible]
P. O. BOX [illegible]
GRAND JUNCTION, COLORADO [illegible]

# MOBILE RADIATION SURVEY

SALT LAKE CITY, UTAH

**Report Period:** April 5 - 11, 1972

| **No.** | **Map** | **Coordinate** | | **Address** | **Background Counts/Sec.** | **Max. Defl. Counts/Sec.** | **Comments** |
|---|---|---|---|---|---|---|---|
| 1 | NE/4 | 700W | 3300S | Vacant Land, 700 W at 3300 So. | 475 | 2,313 | West side, Tailing Pile due north |
| 2 | | | | Vacant Land, 700 West St. | 475 | 1,475 | 120 feet north of 3422, 700 West Street |
| 3 | | | | 3422, 700 West Street | 475 | 650 | |
| 4 | | | | 3415, 3410 South St. | 463 | 725 | |
| 5 | | | | Fire Engineering Co., 700 West St. | 500 | 788 | South of 3363, 700 West Street |
| 6 | | | | 3363, 700 West St. | 600 | 1,663 | South of Tailings Pile, East side |
| 7 | | | | 3349, 700 West St. | 600 | 838 | South of Tailings Pile, East side |
| 8 | | | | 3341, 700 West St. | 600 | 1,213 | South of Tailings Pile, East side |
| 9 | | | | 3327, 700 West St. | 600 | 1,925 | South of Tailings Pile, East side |
| 10 | | | | Address ?, 700 West St. | 600 | 1,825 | North of 3327, 700 West St. |
| 11 | | | | Address ?, 700 West St. | 600 | 2,188 | Corner of 700 W and 3300 So., East side |
| 12 | | 500 W | 3300S | Westerner's Salvage, 500 W. St. | 525 | 788 | Office Building |
| 13 | | 580W | 3740S | 560, 3740 So. Street | 425 | 525 | Drive |
| 14 | | 500W | 3600S | Vacant Land, 500 West St. | 350 | 488 | South of 3585, 500 West Street |
| 15 | | | | 3585, 500 West St. | 500 | 1,150 | |
| 16 | | | 3500S | 3513, 500 West St. | 500 | 2,500 | |
| 17 | | | | 3499, 500 West St. | 500 | 5,525 | |
| 18 | | | | Vacant Lot, 500 West St. | 500 | 9,835 | North of 3499, 500 West St. |
| 19 | | | 3440S | Central Landscape, 500 West St. | 500 | 9,250 | |
| 20 | | 900W | 3300S | 3302, 900 West Street | 575 | 1,225 | Southwest of Tailings Pile, West side |
| 21 | | | 3340S | 3340, 900 West Street | 575 | 1,000 | |
| 22 | | | | 3342, 900 West Street | 575 | 975 | |
| 23 | | | | 3344, 900 West Street | 575 | 800 | |
| 24 | | | | Vacant Lot, 900 West Street | 575 | 750 | South of 3344, 900 West St. |
| 25 | | | 3440S | 3432, 900 West St. | 575 | 963 | Drive |
| 26 | | | 3340S | 3347, 900 West St. | 625 | 775 | Southwest of Tailings Pile, East side |
| 27 | | | | 3339, 900 West St. | 625 | 1,500 | Drive |
| 28 | | | | Address ?, 900 West St. | 625 | 1,025 | North of 3339, 900 West St. |

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LUCIUS PITKIN, INC.
CONTRACTOR FOR UNITED STATES ATOMIC ENERGY COMMISSION
CONTRACT NO. AT [illegible]
P. O. BOX [illegible]
GRAND JUNCTION, COLORADO 81501

# MOBILE RADIATION SURVEY

SALT LAKE CITY, UTAH

**Report Period:** April 5 - 11, 1972

Form LPI-BL-13 (12-70)

| No. | Map | Coordinate | | Address | Background Counts/Sec. | Max. Defl. Counts/Sec. | Comments |
|---|---|---|---|---|---|---|---|
| 29 | NE/4 | 900W | 3300S | 881, 3300 South Street | 625 | 1,400 | |
| 30 | | | | Tailings Pile, 900 West | 625 | 3,300 | 900 West and 3300 South, East side |
| 31 | | | | Vacant Land, 900 West St. | 625 | 4,600 | South Salt Lake City Limits Sign |
| 32 | | | | Sierra Corp., 900 W. St. | 625 | 4,500 | Tailings Pile due East |
| 33 | | | | Vacant Land, 900 W. St. | 625 | 5,450 | North of Sierra Corp. |
| 34 | | | 3200S | 3237, 900 W. St. | 625 | 6,000 | |
| 35 | | | | 3215, 900 W. St. | 625 | 7,700 | |
| 36 | | | | 3195, 900 W. St. | 625 | 10,200 | |
| 37 | | | 3100S | Old Tailings Pond, 900 W. St. | 625 | 23,750 | North of 3195, 900 W. St., continuing 560 feet to Creek |
| 38 | | | | Old Tailings Pond, 900 W. St. | 625 | 14,750 | From small creek north to Mill Creek, East side |
| 39 | | 900W | 2910S | Vacant Land, 900 W. St. | 625 | 1,088-2,900 | From Mill Creek north to railroad, East side |
| 40 | | 900W | 2550S | 2550, 900 West St. | 375 | 525 | |
| 41 | | | | 2560, 900 West St. | 375 | 588 | |
| 42 | | | 2870S | Grand Central Warehouse, 900 W. St. | 550 | 913 | |
| 43 | | | | Vacant Land, 900 W St. | 550 | 1,300 | South of Grand Central Warehouse |
| 44 | | | | Mill Creek, 900 W. St. | 550 | 1,700 | West side of road |
| 45 | | | | Vacant Land, 900 W. St. | 550 | 5,400 | From Mill Creek North to Small Creek, West side |
| 46 | | | | Vacant Land, 900 W. St. | 550 | 6,200 | 260 feet north of Small Creek, West side |
| 47 | | | | Vacant Land, 900 W. St. | 550 | 2,000 | West of Tailings Pile at 3300 So. St. |
| 48 | | 1700W | 2100S | Standard Station, 2100 So. St. | 413 | 3,400 | Redwood Road & 2100 So. St. |
| 49 | | 900W | 2100S | Address,?2100 So. | 375 | 488 | West of 940, 2100 South Street |
| 50 | | | | 989 Jewel Ave. | 325 | 475 | Bricks, two feet away from truck |
| 51 | | 1300W | 3300S | Vacant Lot, 3300 So. St. | 500 | 675 | 140 feet East of 1061, 3300 South St. |
| 52 | | 1000W | 3300S | Vacant Lot, 1000 West St. | 525 | 675 | North of 3363, 1000 West St. |
| 53 | | | | 999, 1000 West St. | 525 | 638 | |
| 54 | | | | Vacant Lot, 3300 South St. | 525 | 813 | East of 999, 3300 South St. |
| 55 | | | | 949, 3300 South St. | 525 | 875 | Southwest of Tailings Pile |
| 56 | | | | Vacant Lot, 3300 South St. | 525 | 888 | East of 949, 3300 South St. |

WESTERN URANIUM PROJECT
**LUCIUS PITKIN, INC.**
CONTRACTOR FOR UNITED STATES ATOMIC ENERGY COMMISSION
[illegible]
P. O. BOX [illegible]
GRAND JUNCTION, COLORADO [illegible]

# MOBILE RADIATION SURVEY

SALT LAKE CITY, UTAH

Report Period: April 5 - 11, 1972

| No. | Map | Coordinate | | Address | Background Counts/Sec. | Max. Defl. Counts/Sec. | Comments |
|---|---|---|---|---|---|---|---|
| 57 | NE1/4 | 900W | 3300S | 925, 3300 South St. | 525 | 1,163 | South of Tailings Pile |
| 58 | | | | 881, 3300 South St. | 525 | 1,600 | |
| 59 | | | | 871, 3300 South St. | 525 | 1,688 | |
| 60 | | | | 863, 3300 South St. | 525 | 2,063 | |
| 61 | | | | 855, 3300 South St. | 525 | 2,500 | |
| 62 | | | | 845, 3300 South St. | 525 | 2,550 | |
| 63 | | | | 837, 3300 South St. | 525 | 4,475 | |
| 64 | | | | Vacant Lot, 3300 South St. | 525 | 6,800 | East of 837, 3300 So. St. south of tailings |
| 65 | | 700W | 3300S | 681, 3300 South St. | 525 | 1,850 | |
| 66 | | | | 671, 3300 South St. | 525 | 1,650 | |
| 67 | | | | 661, 3300 South St. | 525 | 1,695 | |
| 68 | | | | 651, 3300 South St. | 525 | 1,725 | |
| 69 | | | | 647, 3300 South St. | 525 | 1,400 | |
| 70 | | | | 585, 3300 South St. | 525 | 838 | |
| 71 | | | | Western Salvage, 3300 So. St. | 525 | 800 | |
| 72 | | 500W | 3300S | Vacant Land, 3300 So. St. | 525 | 863 | Dirt bank from 500 W to Railroad Underpass |
| 73 | | 300W | 3300S | 315, 3300 So. St. | 375 | 575 | |
| 74 | | 500W | | Vacant Lot, 3300 So. St. | 425 | 988 | Dirt bank, East of Vitro Uranium Mill |
| 75 | | | | Vitro Mill, 3300 South St. | 425 | 1,988 | |
| 76 | | | | Vitro Office, 3300 South St. | 425 | 1,575 | |
| 77 | | | | Parking Lot, 3300 South St. | 425 | 2,500 | West of Vitro's Office |
| 78 | | 700W | 3300S | Tailings Pile, 3300 So. St. | 425 | 12,750 | From Parking Lot, West to Opposite 700 W. |
| 79 | | | | Tailings Pile, 3300 So. St. | 425 | 14,875 | West, opposite 700 W. to paved road |
| 80 | | 900W | | Tailings Pile, 3300 So. St. | 425 | 19,500 | Opposite 835 West St. |
| 81 | | | | Vacant Land, 3300 So. St. | 425 | 1,975 | From 900W to KCPX Radio Station |
| 82 | | 6 W | 800S | M.J.B.T., Genesee | 375 | 525 | Brick, West of 723 Genesee |
| 83 | | | 1300S | Machinery Center, 6th W | 375 | 763 | North of 1201, 6th W |
| 84 | | | 1100S | 1101, 6th W. St. | 375 | 563 | |

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# MOBILE RADIATION SURVEY

*SALT LAKE CITY, UTAH*

**Report Period:** April 5-11, 1972

Form [illegible]

| No. | Map | Coordinate | | Address | Background Counts/Sec. | Max. Defl. Counts/Sec. | Comments |
|---|---|---|---|---|---|---|---|
| 85 | NE/4 | 6 W | 900 S | Pacific Metal, 6th W. St. | 375 | 625 | Brick, 240 feet north of 977, 6th West |
| 86 | | 3 W | 1355 S | 405 California St. | 375 | 838 | |
| 87 | | 600 W | 800 S | 615, 800 South St. | 350 | 488 | Portland Cement offices |
| 88 | | 1300 W | 400 S | LDS Church, 1311, Iola St. | 400 | 538 | Brick |

SUMMATION: MOBILE RADIATION SURVEY
Salt Lake City, Utah

SURVEY COMMENCEMENT DATE: April 5, 1972

CURRENT REPORT PERIOD : April 18-27, 1972

| | | |
|---|---|---|
| Survey Days | | |
| Prior to Report Period | | 7.00 |
| During Report Period | | 8.00 |
| | Total | 15.00 |
| Structures Surveyed | | |
| Prior to Report Period | | 3,871 |
| During Report Period | | 6,995 |
| | Total | 10,866 |
| Radiation Anomalies | | |
| Prior to Report Period | | 88 |
| During Report Period | | 35 |
| | Total | 123 |
| Miles Surveyed | | |
| Prior to Report Period | | 54.90 |
| During Report Period | | 66.40 |
| | Total | 121.30 |

# MOBILE RADIATION SURVEY

SALT LAKE CITY, UTAH

**Report Period:** April 18-27, 1972

| No. | Map | Coordinate | | Address | Background Counts/Sec. | Max. Defl. Counts/Sec. | Comments |
|---|---|---|---|---|---|---|---|
| 1 | NE1/4 | 1300W | 800S | 1400 Indiana Avenue | 425 | 550 | Brick |
| 2 | | 900W | 500S | 484, 9th West Street | 375 | 500 | Brick |
| 3 | | 900W | 400S | 1036, 400 South Street | 400 | 513 | Brick |
| 4 | | 900W. | 400S | Church, Goshen Street | 375 | 550 | Brick, south of 344 Goshen Street |
| 5 | | 900W | 300S | 325 and 329 Post Street | 375 | 525 | Between properties |
| 6 | | 1500W | 700S | Old Vacant School, Wasatch | 475 | 663 | Brick, West of 1387 Wasatch Avenue |
| 7 | | 1500W | 900S | Address ?, Indiana Avenue | 400 | 525 | Brick, South of 1527, 800 South |
| 8 | | 1300W | 200S | Navajo Street Underpass at 200 S St. | 450 | 713 | Concrete Underpass |
| 9 | | 900W | 400S | 402, 900 West Street | 375 | 600 | Brick, 15 feet away |
| 10 | | 600W | 400S | 412, 600 West | 375 | 575 | Brick |
| 11 | | 700W | 400S | Ketcham's Hardware, 400 S. | 350 | 513 | Brick, 10 feet away |
| 12 | | 900W | 200S | 9th W. St. Underpass at I-80 | 375 | 413 | Concrete Underpass |
| 13 | | 1000W | 200S | 175, 10th West St. | 425 | 700 | Brick, 5 feet away |
| 14 | | 1300W | · 200S | 151 Navajo Street | 375 | 525 | Brick |
| 15 | | 1300W | 200S | 122 Navajo Street | 375 | 550 | Brick |
| 16 | | 900W | 100S | 930, 100 South Street | 375 | 475 | Brick |
| 17 | | 1100W | 100N | Building No. 11, State Fairgrounds | 375 | 650 | Brick, 10 feet away |
| 18 | | 1100W | 100N | Coliseum, State Fairgrounds | 413 | 525 | Brick |
| 19 | | 1300W | 500N | 488 Colorado Street | 425 | 538 | |
| 20 | | 800W | 400N | Church, Grant Street | 375 | 475 | Brick, 160 feet South of 435 Grant |
| 21 | | 1200W | 1100N | 1301 Valentine Street | 400 | 500 | |
| 22 | | 1000W | 1100N | Address, Topaz St. | 400 | 475 | West of 971, 11th North Street |
| 23 | | 1400W | 1000N | Northwest Jr. Hi School, Goodwin | 375 | 475 | Brick |
| 24 | | 1200W | 700N | Church, Picture Drive | 400 | 500 | Brick, South of 7th N |
| 25 | | 1000W | 500N | 610 Colorado Street | 400 | 500 | |
| 26 | | [illegible] | 3900S | Vacant Lot, 3900 South St. | 425 | 875 | 200 feet East of 41, 3900 So. Street |
| 27 | | [illegible] | [illegible] | [illegible] South Main Street | 400 | 1,000 | |
| 28 | | [illegible] | [illegible] | Fire Station, [illegible] Main | 475 | 2,125 | |

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CONTRACTOR FOR UNITED STATES ATOMIC ENERGY COMMISSION
P. O. BOX 1888
GRAND JUNCTION, COLORADO 81501

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# MOBILE RADIATION SURVEY

SALT LAKE CITY, UTAH

Form [illegible]

**Report Period:** April 18-27, 1972

| No. | Map | Coordinate | | Address | Background Counts/Sec. | Max. Defl. Counts/Sec. | Comments |
|---|---|---|---|---|---|---|---|
| 29 | NE1/4 | 300W | 3300S | 3451,300 West St. | 425 | 550 | |
| 30 | | 300W | 3300S | 3365, 300 West St. | 450 | 2,375 | |
| 31 | | 100E | 3600S | Bank, Corner of Helm & State St. | 375 | 500 | Brick, east side |
| 32 | | 100E | 3300S | 3319 South State Street | 388 | 513 | Brick |
| 33 | | 100E | 3500S | 3566 South State Street | 400 | 513 | Brick |
| 34 | | 100E | 3600S | Dace Sporting, South State St. | 400 | 538 | Brick |
| 35 | | 100E | 3900 | Albertson's, South State Street | 400 | 575 | Brick |

[illegible] FOR UNITED STATES ATOMIC ENERGY COMMISSION
CONTRACT NO. AT [illegible]
P. O. BOX 1569
GRAND JUNCTION, COLORADO 81501

## SUMMATION: MOBILE RADIATION SURVEY
## Salt Lake City, Utah

| | |
|---|---|
| SURVEY COMMENCEMENT DATE: | April 5, 1972 |
| CURRENT REPORT PERIOD : | May 3-6, 1972 |

| | |
|---|---|
| Survey Days | |
| Prior to Report Period | 15.00 |
| During Report Period | 3.50 |
| Total | 18.50 |
| Structures Surveyed | |
| Prior to Report Period | 10,866 |
| During Report Period | 2,364 |
| Total | 13,230 |
| Radiation Anomalies | |
| Prior to Report Period | 123 |
| During Report Period | 47 |
| Total | 170 |
| Miles Surveyed | |
| Prior to Report Period | 121.30 |
| During Report Period | 20.03 |
| Total | 141.33 |

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# MOBILE RADIATION SURVEY

## SALT LAKE CITY, UTAH

**Report Period:** May 3-6, 1972

| No. | Map | Coordinate | | Address | Background Counts/Sec. | Max. Defl. Counts/Sec. | Comments |
|---|---|---|---|---|---|---|---|
| 1 | N1/2 | 200E | 3400S | Address ?, State Street | 400 | 563 | Brick, Corner of Ford & State, South Side |
| 2 | | 100E | 3050S | Holiday Inn Cafe, Gresson Street | 400 | 625 | Parking Lot in rear |
| 3 | | 100W | 2950S | 2955-2975 West Temple | 375 | 550 | Large Brick Building |
| 4 | | 0 | 2850S | 2880 South Main Street | 375 | 475 | Brick |
| 5 | | 100E | 2850S | Address, Louise Street | 350 | 475 | Brick, East of 80 Louise St. |
| 6 | | 100W | 2450S | 2465 West Temple | 400 | 525 | Brick |
| 7 | | 100W | 2650 | 2650 West Temple | 350 | 450 | Brick |
| 8 | | 200W | 3300S | Address ? Walton Street | 400 | 713 | Yard, Old equipment, 120 feet west of 129 Walton |
| 9 | | 100E | 2400S | Underpass, I-80 & State Street | 375 | 525 | Concrete |
| 10 | | 100E | 2700S | 2740 South State Street | 375 | 488 | |
| 11 | | 100E | 3030S | 3035 South State Street | 425 | 525 | Brick |
| 12 | | 100E | 3040S | 3040 South State Street | 425 | 500 | |
| 13 | | 100E | 3000S | 3007 South State Street | 400 | 500 | Driveway |
| 14 | | 100E | 2935S | 2935 South State Street | 400 | 550 | Brick ? |
| 15 | | 100E | 2600S | 2615 South State Street | 375 | 475 | Brick |
| 16 | | 100E | 2560S | 2561 South State Street | 375 | 500 | Brick |
| 17 | | 100E | 2560S | 2567 South State Street | 375 | 500 | Brick |
| 18 | | 100E | 2300S | Address ?, Burton Avenue | 375 | 575 | West of 37 Burton St., Cinder Block |
| 19 | | 100E | 2300 S | 62 Burton Avenue | 375 | 475 | |
| 20 | | 100E | 2300S | 7 Burton Avenue | 375 | 525 | Brick |
| 21 | | 100E | 2300S | Address ? Burton Avenue | 375 | 550 | Howe Rental, East of 22 Burton Avenue |
| 22 | | 100E | 2550S | 2550 South State Street | 375 | 500 | Brick |
| 23 | | 100W | 2550S | 2550 West Temple | 375 | 488 | Brick |
| 24 | | 100W | 2600S | 150 Stratford Avenue | 375 | 488 | Brick |
| 25 | | 200W | 2600S | Vacant Lot, Stratford Avenue | 375 | 1,125 | West of 150 Stratford, near railroad |
| 26 | | 200W | 2650S | 179 Crystal Avenue | 375 | 550 | Near railroad |
| 27 | | 100W | 3100S | Address ?, West Temple | 375 | 513 | Brick, Across the street from 3140 W. Temple |
| 28 | | 100W | 3100S | 37 Miller Street | 375 | 475 | |

# MOBILE RADIATION SURVEY

SALT LAKE CITY, UTAH

**Report Period:** May 3-6, 1972

| No. | Map | Coordinate | | Address | Background Counts/Sec. | Max. Defl. Counts/Sec. | Comments |
|---|---|---|---|---|---|---|---|
| 29 | N1/2 | O-E, O-W | 2500S | Underpass of I-80 & Main | 375 | 588 | Concrete |
| 30 | | " | 2500S | Bondwood Bowl, Whitlock | 350 | 588 | Brick, three feet away |
| 31 | | " | 2500S | 2511 West Temple | 350 | 750 | Brick, two feet away |
| 32 | | " | 2700S | 2701 South Main Street | 350 | 525 | Stucco, four feet away |
| 33 | | " | 2700S | 2685 South Main Street | 350 | 488 | Brick |
| 34 | | 100W | 2700S | Address ?, West, 2700 South Street | 375 | 475 | Brick, east of 31 West 2700 So. St. |
| 35 | | 100E | 2700S | 14 East, 2700 South Street | 375 | 488 | Brick |
| 36 | | 100E | 2700S | 2700 South State St. | 375 | 588 | |
| 37 | | 300E | 2700S | Church, 2700 South St. | 400 | 550 | Brick, East of 300 East, South Side |
| 38 | | 300E | 2800S | 2782 Blair Street | 350 | 463 | |
| 39 | | 550E | 2700S | 563 East, 2700 So. St. | 375 | 475 | Brick |
| 40 | | 550E | 2700S | 555 East 2700 So. St. | 375 | 475 | Brick |
| 41 | | 550E | 2700S | 547 East 2700 So. St. | 375 | 475 | Brick |
| 42 | | 550E | 2700S | 545 East 2700 So. St. | 375 | 475 | Brick |
| 43 | | 100E | 2600S | 2547 South State Street | 375 | 525 | Brick |
| 44 | | 100E | 2500S | School, Oakland Avenue | 400 | 600 | Brick |
| 45 | | O-E, O-W | 2300S | 2319 South State Street | 375 | 463 | Brick |
| 46 | | " | 2300S | Address ?, South State St. | 375 | 538 | Brick, ac ross the street, West of 2319 State |
| 47 | | 100W | 2300S | 2325 South State Street | 350 | 450 | Brick |

WESTERN URANIUM PROJECT
LUCIUS PITKIN, INC.
P. O. BOX 1360
GRAND JUNCTION, COLORADO 81501

## SUMMATION: MOBILE RADIATION SURVEY
## Salt Lake City, Utah

SURVEY COMMENCEMENT DATE: April 5, 1972

CURRENT REPORT PERIOD : June 9 - 13, 1972

| | | |
|---|---|---|
| **Survey Days** | | |
| Prior to Report Period | | 18.50 |
| During Report Period | | 5.00 |
| | Total | 23.50 |
| **Structures Surveyed** | | |
| Prior to report period | | 13,230 |
| During report period | | 3,149 |
| | Total | 16,379 |
| **Radiation Anomolies** | | |
| Prior to report period | | 170 |
| During report period | | 25 |
| | Total | 195 |
| **Miles Surveyed** | | |
| Prior to report period | | 141.33 |
| During report period | | 27.89 |
| | Total | 169.22 |

# MOBILE RADIATION SURVEY

SALT LAKE CITY, UTAH

Report Period: June 9-13, 1972

| No. | Map | Coordinate | | Address | Background Counts/Sec. | Max. Defl. Counts/Sec. | Comments |
|---|---|---|---|---|---|---|---|
| 1 | N1/2 | 200E | 2200S | Junk Yard, 2nd East | 350 | 500 | West side, 360 feet south of Wentworth Avenue |
| 2 | | 200E | 2200S | Address ?, Wentworth Avenue | 375 | 500 | Brick, west of 134 Wentworth Avenue |
| 3 | | 300E | 2400S | Underpass, 3rd East & Highway 80 | 375 | 663 | Concrete |
| 4 | | 500E | 2400S | Underpass, 5th East & Highway 80 | 375 | 588 | Concrete |
| 5 | | 500E | 2700S | 501 East, 2700 South | 375 | 563 | Brick |
| 6 | | 700E | 300S | 342 South, Seventh East | 350 | 475 | Brick |
| 7 | | 700E | 300S | 350 South, Seventh East | 350 | 475 | Brick |
| 8 | | 700E | 400S | 440 South, Seventh East | 375 | 475 | Brick |
| 9 | | 700E | 1700S | Hawthorne School, 7th E. | 375 | 550 | Brick |
| 10 | | 700E | 2200S | 2226 South, Seventh East | 350 | 463 | Brick |
| 11 | | 700E | 2400S | Underpass, 7th E. & Highway 80 | 350 | 488 | Concrete |
| 12 | | 700E | 1400S | 1399 South, 7th East | 375 | 488 | |
| 13 | | 700E | 900S | Address ?, 900 S., 700E | 375 | 475 | Brick, North of 919 S, 700E |
| 14 | | 700E | 100S | Address ?, 700 East | 375 | 600 | Brick, South of 100 South, East side |
| 15 | | 200E | 2800S | 2795 South State Street | 375 | 575 | Brick |
| 16 | | 100E | 3300S | 141 E, 3185 South Street | 375 | 725 | Driveway, East of 135 E, 3185 South Street |
| 17 | | 100E | 2950S | Motel, Garden Street | 375 | 500 | Brick, West of 116 East Garden Street |
| 18 | | 300E | 2700S | Church, 3rd East | 400 | 525 | Brick, North of 2721 S., 3rd. E. |
| 19 | | 900E | 2700S | Address ?, 900 East | 425 | 525 | Market, Brick, North of 2713 S., 900E. |
| 20 | | 900E | 2400S | Underpass, 900 East & Highway 80 | 400 | 550 | Concrete |
| 21 | | 900E | 2100S | 2179 South, 900 East | 375 | 500 | Brick |
| 22 | | 900E | 1300S | 1307 South, 900 East | 400 | 513 | Brick |
| 23 | | 900E | 1100S | 1093 South, 900 East | 375 | 488 | Brick |
| 24 | | 900E | 3300S | 3230 South, 900 East | 400 | 525 | Brick |
| 25 | | 100E | 3900S | Pizza Place, 3900 South | 375 | 538 | Brick, 100 feet West of 123 E., 3900 S. |

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## SUMMATION: MOBILE RADIATION SURVEY
## Salt Lake City, Utah

SURVEY COMMENCEMENT DATE: April 5, 1972

CURRENT REPORT PERIOD : June 20-27, 1972

### Survey Days

| | |
|---|---|
| Prior to Report Period | 23.50 |
| During Report Period | 7.00 |
| Total | 30.50 |

### Structures Surveyed

| | |
|---|---|
| Prior to Report Period | 16,379 |
| During Report Period | 3,778 |
| Total | 20,157 |

### Radiation Anomolies

| | |
|---|---|
| Prior to Report Period | 195 |
| During Report Period | 5 |
| Total | 200 |

### Miles Surveyed

| | |
|---|---|
| Prior to Report Period | 169.22 |
| During Report Period | 42.69 |
| Total | 211.91 |

# MOBILE RADIATION SURVEY

SALT LAKE CITY, UTAH

**Report Period:** June 20-27, 1972

| No. | Map | Coordinate | | Address | Background Counts/Sec. | Max. Defl. Counts/Sec. | Comments |
|---|---|---|---|---|---|---|---|
| 1 | N1/2 | 2700W | 3650S | 3690 South, 2740 West | 400 | 525 | Granger Area |
| 2 | | 2700W | 3650S | 3687 South, 2740 West | 400 | 4,900 | |
| 3 | | 2000W | 3500S | Address ?, 3500 South | 375 | 525 | West of 1962 West, 3500 South |
| 4 | | 3200W | 4100S | Address ?, 4100 South | 375 | 1,625 | West of 3266 West, 4100 South |
| 5 | | 3520W | 3900S | 3895 South, 3520 West | 375 | 525 | |

WESTERN URANIUM PROJECT
LUCIUS PITKIN, INC.
CONTRACTOR FOR UNITED STATES ATOMIC ENERGY COMMISSION
[illegible]
P. O. BOX [illegible]
GRAND JUNCTION, COLORADO 81501

## SUMMATION: MOBILE RADIATION SURVEY
## Salt Lake City, Utah

| | |
|---|---|
| SURVEY COMMENCEMENT DATE: | April 5, 1972 |
| CURRENT REPORT PERIODS : | July 11-18, 1972<br>July 24 - August 1, 1972 |

| | |
|---|---|
| **Survey Days** | |
| Prior to Report Period | 30.50 |
| During Report Periods | 16.00 |
| Total | 46.50 |
| **Structures Surveyed** | |
| Prior to Report Period | 20,157 |
| During Report Periods | 8,860 |
| Total | 29,017 |
| **Radiation Anomalies** | |
| Prior to Report Period | 200 |
| During Report Periods | 38 |
| Total | 238 |
| **Miles Surveyed** | |
| Prior to Report Period | 211.91 |
| During Report Periods | 116.58 |
| Total | 328.49 |

# MOBILE RADIATION SURVEY

Form LPI-[illegible]

SALT LAKE CITY, UTAH

July 11-18, 1972
Report Period: July 24 - August 1, 1

| No. | Map | Coordinate | | Address | Background Counts/Sec. | Max. Dofl. Counts/Sec. | Comments |
|---|---|---|---|---|---|---|---|
| 1 | N-1/2 | 2050W | 3145S | 3130 South, 2050 West | 400 | 1,450 | Front Yard |
| 2 | N-1/2 | 6000W | 3500S | Whittier School | 425 | 575 | Brick |
| 3 | N-1/2 | 8400W | 3240S | 8390 West Powell Street | 375 | 488 | Southeast Magna Area |
| 4 | N-1/2 | 9100W | 2900S | Address.?, 9100 West, 2900 South | 425 | 525 | Brick, north of 2900 S, East Side |
| 5 | | 9100W | 2860S | Address ?, 9100 West 2860 South | 375 | 475 | Brick ?, south of 2860 S, East Side |
| 6 | | 9100W | 2700S | 9080 West, 2700 South | 425 | 575 | Brick, "Out House Bar" |
| 7 | | 9100W | 2700S | Address ?, 9100 West | 375 | 475 | Brick, north of 2700 S, East Side |
| 8 | | 9100W | 2700S | Rexall Drug, 2700 South | 375 | 563 | Brick |
| 9 | | 9100W | 3000S | 2960 South, 9100 West | 400 | 500 | |
| 10 | | 9100W | 3100S | 3068 South, 9100 West | 400 | 500 | |
| 11 | | 9150W | 2700S | Bank, 9150 West, 2700S | 375 | 613 | Brick, 10 feet away |
| 12 | | 9150W | 2700S | Address ?, 9150 West | 375 | 588 | Brick, 15 feet away, South of 2700 S, West Side |
| 13 | | 8800W | 3100S | 8810 West, 3100 South | 388 | 500 | |
| 14 | | 8850W | 3000S | Vacant Lot, 8850 West | 375 | 488 | South of 2920 South, 8850 West |
| 15 | | 8650W | 2800S | 2828 South, 8850 West | 425 | 525 | |
| 16 | | 8900W | 2800S | 2792 South, 8900 West | 425 | 575 | |
| 17 | | 8950W | 2800S | 8927 West, 2800 South | 400 | 588 | Stucco |
| 18 | | 9100W | 2900S | 2891 South, 9100 West | 425 | 600 | Brick |
| 19 | | 8950W | 2700S | Theatre, 8950W, 2700S | 400 | 700 | Brick, 15 feet away |
| 20 | | 8950W | 2700S | Magna Water, 8950 W, 2700S | 400 | 563 | Brick, 20 feet away |
| 21 | | 8950W | 2700S | Vacant Lot, 8950 West | 400 | 538 | South of 2700S, West Side |
| 22 | | 9050W | 3000S | Vacant Lot, 9050 West | 375 | 500 | North of 3017 So., 9050 West |
| 23 | | 9050W | 3000S | Vacant Lot, 9050 West | 375 | 513 | South of 2979 So., 9050 West |
| 24 | | 8950W | 3000S | A&G Market, 8950 West | 375 | 475 | Brick |
| 25 | | 8800W | 3000S | School, 3000 South | 375 | 538 | |
| 26 | | 8650W | 2800S | 2817 South, 8650 West | 425 | 525 | |
| 27 | | 8650W | 2800S | 2824 South, 8650 West | 425 | 525 | |
| 28 | | 8600W | 2700S | 2711 South, 8600 West | 375 | 538 | Brick |

# MOBILE RADIATION SURVEY

SALT LAKE CITY, UTAH

July 11-18, 1972
Report Period: July 24 - August 1, 1972

| No. | Map | Coordinate | | Address | Background Counts Sec. | Max. Defl. Counts Sec. | Comments |
|---|---|---|---|---|---|---|---|
| 29 | N-1/2 | 8600W | 2700S | Vacant Lot, 8600 West | 375 | 513 | North of 2634 South, 8600 West |
| 30 | | 2700W | 900S | 2180 DeLong (Chestnut on Map) | 375 | 750 | Buena Vista Area |
| 31 | | 1300E | 3300S | 1444 East, 3300 South | 400 | 488 | |
| 32 | | 2300E | 3300S | 2405 East, 3300 South | 375 | 475 | |
| 33 | | 1300E | 3300S | Lumber Yard, 3300 South | 375 | 538 | Brick, 15 feet away. West of 3270 Highland Drive |
| 34 | | 1100E | 3300S | 1103 East, 3300 South | 400 | 500 | Brick 15 feet away |
| 35 | | 1300E | 3700S | 1445 East Murphy's Lane | 375 | 450 | Brick & Rock |
| 36 | | 1300E | 3700S | 1435 East Murphy's Lane | 375 | 525 | Brick & Rock |
| 37 | | 3400E | 3900S | Underpass I-215, 3900 South | 400 | 513 | Concrete |
| 38 | | 2300E | 3700S | 3695 South, 2175 East | 400 | 500 | |

LUCIUS PITKIN, INC.
P. O. BOX [illegible]
GRAND JUNCTION, COLORADO [illegible]

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## SUMMATION: MOBILE RADIATION SURVEY
## Salt Lake City, Utah

| | |
|---|---|
| SURVEY COMMENCEMENT DATE: | April 5, 1972 |
| CURRENT REPORT PERIODS : | August 9 - 15, 1972<br>August 22 - 29, 1972 |
| **Survey Days** | |
| Prior to Report Period | 46.50 |
| During Report Periods | 13.00 |
| **Total** | 59.50 |
| **Structures Surveyed** | |
| Prior to Report Period | 29,017 |
| During Report Periods | 6,986 |
| **Total** | 36,003 |
| **Radiation Anomalies** | |
| Prior to Report Period | 238 |
| During Report Periods | 23 |
| **Total** | 261 |
| **Miles Surveyed** | |
| Prior to Report Period | 328.49 |
| During Report Periods | 61.54 |
| **Total** | 390.03 |

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GRAND JUNCTION, COLORADO [illegible]

# MOBILE RADIATION SURVEY

Report Period: August 9 - 15, 1972
August 22 - 29, 1972

| No. | Map | Coordinate | | Address | Background Counts/Sec. | Max. Defl. Counts/Sec. | Comments |
|---|---|---|---|---|---|---|---|
| 1 | N 1/2 | 3400S | 2700E | Old Mill, Evergreen | 375 | 513 | West of 2750 Evergreen |
| 2 | " | 3760S | 3500E | Underpass, I-212 & 3760S | 400 | 588 | Concrete |
| 3 | " | 3500S | 3650E | LDS Church, Mill Stream Lane | 425 | 525 | Brick |
| 4 | " | 3500S | 3800E | 3431 So. Crestwood Drive | 475 | 613 | Soil embankment |
| 5 | " | 3300S | 3800E | 3351 & 3357 South Crestwood Dr. | 375 | 475 | |
| 6 | " | 3300S | 700E | Church, Jeppson | 375 | 588 | Brick, west of 727 East Jeppson |
| 7 | " | 2600S | 800E | 2583 South, 800 East | 375 | 525 | |
| 8 | " | 2700S | 1000E | Address ?, 1000 East | 375 | 513 | Brick, north of 2756 South, 1000 East |
| 9 | " | 3000S | 1300E | Bank, Elgin & Highland Dr. | 375 | 500 | Brick |
| 10 | " | 3000S | 1300E | 3010 South Richmond | 400 | 500 | Brick |
| 11 | " | 3200S | 1100E | 3194 South Riches Ave. | 425 | 538 | Stucco |
| 12 | " | 3100S | 1100E | Brick yard, Welby Avenue | 375 | 513 | Corner of Welby & 1100 E, south side |
| 13 | " | 3000S | 1000E | 1005 E. Austin | 400 | 513 | Brick |
| 14 | " | 3100S | 1100E | Brick yard, 1100 East | 400 | 713 | Between Welby and Riches, both sides of street |
| 15 | " | 3300S | 1100E | Address ?, 1100 East | 413 | 613 | Brick, south of 3233 South, 1100 East |
| 16 | " | 3100S | 1300E | Villa, Gunn and Highland | 375 | 588 | Brick |
| 17 | " | 2700S | 900E | A&G Market, 2700 South | 375 | 525 | Brick, East of 900 East, South Side |
| 18 | " | 2900S | 1500E | 1527 Zenith | 400 | 600 | East side of house |
| 19 | " | 2400S | 1300E | 2420 Highland Drive | 375 | 538 | 100 feet south of Power Transformers |
| 20 | " | 2500S | 1500E | A&G Market, Glenmore & Stratford | 375 | 488 | Brick |
| 21 | " | 3300S | 1400E | Church, Woodland & Highland Drive | 375 | 725 | Brick |
| 22 | " | 3300S | 1600E | Address ?, 1575 East | 400 | 525 | Brick, Corner of 1575 E & 3300S, West side |
| 23 | " | 3000S | 1300E | Address ?, 3000 South | 375 | 550 | Brick, Corner of 3000S and Highland, East side |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

## SUMMATION: MOBILE RADIATION SURVEY
## Salt Lake City, Utah

SURVEY COMMENCEMENT DATE: April 5, 1972

CURRENT REPORT PERIOD : September 14-21, 1972

### Survey Days

| | |
|---|---|
| Prior to Report Period | 59.50 |
| During Report Period | 7.00 |
| **Total** | 66.50 |

### Structures Surveyed

| | |
|---|---|
| Prior to Report Period | 36,003 |
| During Report Period | 3,298 |
| **Total** | 39,301 |

### Radiation Anomalies

| | |
|---|---|
| Prior to Report Period | 261 |
| During Report Period | 11 |
| **Total** | 272 |

### Miles Surveyed

| | |
|---|---|
| Prior to Report Period | 390.03 |
| During Report Period | 26.90 |
| **Total** | 416.93 |

LUCIUS PITKIN, INC.
[illegible]
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P O BOX 1166
GRAND JUNCTION, COLORADO 81501

# MOBILE RADIATION SURVEY

Form LPI-DL-13 (12-70)

Report Period: September 14-21, 1972

| No. | Map | Coordinate | | Address | Background Counts/Sec. | Max. Defl. Counts/Sec. | Comments |
|---|---|---|---|---|---|---|---|
| 1 | N 1/2 | 2700S | 2000E | 2730 South, 2000 East | 375 | 488 | Brick |
| 2 | | 2920S | 2000E | LDS Church, Mary Dot Way | 375 | 500 | Brick |
| 3 | | 2980S | 2700E | 2980 SoutH, 2700 East | 400 | 575 | |
| 4 | | 3300S | 100E | 67 East, 3300 South | 375 | 538 | Brick |
| 5 | | 3300S | 100E | Church, 3300 South | 375 | 550 | West of 67 East, 3300 South, Brick |
| 6 | | 3300S | 100W | 10 West, 3300 South | 375 | 488 | Brick |
| 7 | | 3300S | 200W | 184 West, 3300 South | 375 | 3,900 | Mountain States Supply Company |
| 8 | | 3300S | 100W | Vacant Lot, 3300 South | 375 | 550 | East of 157 West, 3300 South |
| 9 | | 3300S | 200E | 220 East, 3300 South | 375 | 488 | Brick |
| 10 | | 3300S | 700E | 704 East, 3300 South | 375 | 488 | |
| 11 | | 900S | 400E | 922 South, 400 East | 325 | 500 | |

# APPENDIX C

## RECOMMENDATIONS OF ACTION FOR RADIATION EXPOSURE LEVELS IN DWELLINGS CONSTRUCTED ON OR WITH URANIUM MILL TAILINGS

### External Gamma Radiation

| Level | Recommendations |
|---|---|
| Greater than 0.1 mR/hr | Remedial action indicated |
| From 0.05 to 0.1 mR/hr | Remedial action may be suggested |
| Less than 0.05 mR/hr | No action indicated |

### Indoor Radon Daughter Products

| Level | Recommendations |
|---|---|
| Greater than 0.05 WL | Remedial action indicated |
| From 0.01 to 0.05 WL | Remedial action may be suggested |
| Less than 0.01 WL | No action indicated |

### EXPLANATORY NOTES

1. These recommendations are written specifically for dwellings constructed on or with uranium mill tailings. This situation may involve continuous exposure of members of the public to radon daughter product activities and whole-body gamma irradiation levels in excess of the background radiation levels found within dwellings in the area not constructed with or on uranium mill tailings.

2. Although the initial concern was the presence of radon daughter product activities within these dwellings, preliminary surveys have indicated that, in some instances, the gamma radiation levels were of prime importance. Thus, recommendations are made concerning both types of radiation. The recommendation applicable to a particular dwelling will be determined by whichever type of radiation has the higher level.

3. Three levels for action are recommended for both external gamma and radon daughter product exposures. This graded system of actions is proposed to allow latitude in the middle ranges for the judgment of the on-site investigators.

4. The external gamma and radon daughter product levels proposed constitute exposures which are in addition to the natural background levels found within dwellings in the area not constructed on or with uranium mill tailings. In the Grand Junction, Colorado, area these levels are approximately 0.01 mR/hr (approximately 90 mrem/yr) and 0.004 Working Levels (WL) (approximately 0.2 CWLM/yr) respectively (1).

5. The expected health effects of concern will be different for the two types of radiation, i.e., leukemia for whole body gamma radiation exposure and lung cancer for exposure to inhaled radon daughter products. This expectation is based, in part, on findings derived from population studies such as the Japanese atomic bomb survivors and uranium miners. These specific health effects are considered to be mutually exclusive. The basis for this assumption is that the expected radiation contribution to whole body exposure from inhaled

radon and daughter products would be considerably less than the direct exposure from external gamma radiation at the levels encountered in the dwellings. Conversely, the external gamma radiation contribution to the lung dose is considered to comprise a negligible additional risk of lung cancer.

6 a. A Working Level (WL) is the term used to describe radon daughter product activities in air. This term is defined as any combination of short-lived radon daughter products in 1 liter of air that will result in the ultimate emission of $1.3 \times 10^5$ MeV of potential alpha energy (2). The numerical value of the WL is derived from the alpha energy released by the total decay through Ra C' of the short-lived radon daughter products, Ra A, Ra B and Ra C, at radioactive equilibrium with 100 pCi of $^{222}Rn$ per liter of air (3).

6 b. A Working Level Month (WLM) is the term used to express the occupational exposure incurred in one working month of 170 hours by a uranium miner laboring in an atmosphere containing radon daughter products; i.e., one working month in a mine atmosphere containing 1 WL of radon daughter products equals 1 WLM.

6 c. Cumulative Working Level Months (CWLM) is the term used to express the total accumulated occupational exposure to radon daughter products in air; i.e., an air concentration of radon daughter products of 1 WL would, in one working month, equal 1 WLM, and in 1 year or 12 months would equal 12 CWLM.

6 d. Since occupational exposures are based upon 170 hours per month and continuous exposure involves approximately 170 hours per

week, then an occupational exposure to an air concentration of 1 WL is equivalent to continuous exposure to 0.25 WL.

7. These recommendations are based on the assumption of a linear, non-threshold dose-effect relationship. The lack of definitive information precludes allowances for possible differences in radiosensitivity due to age, sex, or other biological characteristics.

8. No action is indicated when the external gamma exposure rate is less than 0.05 mR/hr and the radon daughter product activity is less than 0.01 WL since under conditions of continuous exposure these levels would result in maximum annual exposures of approximately 400 mrem and 0.5 CWLM, respectively. The maximum annual value of 400 mrem is less than the dose limits recommended for an individual member of the general public by the FRC (4) and ICRP (5) for whole body exposure to external gamma irradiation.

The ICRP (5) recommends that the annual dose limit for members of the public shall be 1/10 of the corresponding annual occupational maximum permissible dose. The maximum annual value of 0.5 CWLM of radon daughter product exposure is approximately 1/10 of the 4 CWLM annual occupational exposure limit recommended by the FRC (6) for implementation on 1 January 1971, and less than 1/20 of the annual occupational exposure limit of 12 CWLM recommended for uranium miners in the present FRC regulations (4).

9. Remedial action may be suggested in the case of external gamma exposure rates of 0.05-0.10 mR/hr or radon daughter product activities of 0.01-0.05 WL since under conditions of continuous exposure

these levels would result in maximum annual exposures of approximately 400-900 mrem and 0.5-2.5 CWLM. The upper limit of these ranges exceeds the strictly applied recommendations of the FRC and ICRP for exposures of an individual member of the public. However, this extension seems justified in situations in which unforeseen exposures have occurred, since as stated by ICRP (5) "in general it will be appropriate to institute countermeasures only when their social cost and risk will be less than those resulting from the exposure." It is further stated by the ICRP (5) that very low levels of risk are implied in the dose limits for members of the public and that it is likely to be of minor consequence to their health if the dose limits are marginally or even substantially exceeded.

10. Remedial action is indicated at gamma exposures greater than 0.1 mR/hr or at radon daughter product activities greater than 0.05 WL. Under conditions of continuous exposure, these levels would result in minimum annual exposures of 900 mrem and 2.5 CWLM. All values above these would indicate the necessity for remedial action, since at these levels the maximum annual exposures recommended by the FRC and ICRP for an individual member of the public is exceeded.

11. With respect to the external gamma irradiation, from the estimates published by ICRP (7), it can be interpolated that the annual risk of leukemia under conditions of continuous exposure to 500 mrem per year is an increased incidence of about 10 cases per year per million persons exposed. The natural annual incidence of leukemia for all ages is given by ICRP (8) as 10-100 cases per million persons.

With respect to radon daughter product exposures, it has been estimated by Archer and Lundin (9) that an exposure of 120 CWLM to a group of white adult males in the United States appears to approximately double the normal lung cancer incidence which for this population is about 2-3 cases per year per 10,000 persons. At an annual exposure of 2.5 CWLM, 48 years would be required to reach 120 CWLM.

12. It is considered that implementation of these recommendations for the various exposure ranges would make it highly unlikely that any serious health effects would result from exposure to radon daughter products or external gamma irradiation in this particular situation.

13. It is suggested that remedial action be taken only after an adequate number of measurements taken under a diversity of temporal and climatic conditions have clearly established that the average exposure is in excess of 0.1 mR/hr or 0.05 WL.

14. It is recognized that some time lapse will be inherent in establishing that radiation levels in excess of 0.1 mR/hr or 0.05 WL exist and in instituting corrective measures. However, it is considered that the additional health risks from continued exposure over this time period are of lesser consequence than the economic and social discomfitures of precipitous action.

APPROVED:

Jesse L. Steinfeld, M.D.
Surgeon General
Public Health Service

27 July 1970
Date

# References

1. Personal communication. Mr. Robert D. Siek, Colorado State Department of Health.

2. U. S. Public Health Service Publication No. 494. Control of Radon and Daughters in Uranium Mines and Calculations on Biologic Effects, 1957.

3. Federal Radiation Council Report No. 8 Revised. Guidance for the Control of Radiation Hazards in Uranium Mining, 1967.

4. Federal Radiation Council Report No. 1. Background Material for the Development of Radiation Protection Standards, 1960.

5. Recommendations of the International Commission on Radiological Protection. ICRP Publication 9 (1966).

6. Federal Register, Vol. 34, No. 10 pp 576-577 (1969).

7. The Evaluation of Risks from Radiation. ICRP Publication 8 (1966).

8. Radiosensitivity and Spatial Distribution of Dose. ICRP Publication 14 (1969).

9. V. E. Archer and F. E. Lundin, Jr.: Radiogenic Lung Cancer in Man: Exposure-Effect Relationship, Environmental Research 1, 370-383 (1967).

# APPENDIX D.

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UTAH COMPREHENSIVE BY CITY, STREET ADD.      PAGE                 C   L   S
SALT LAKE CITY, UT                           01/09/73             L T E M C
                                                                  A Y V A P U M
LOC.NO.        ADDRESS             OCCUPANT          HOG    MIG   S P E T E S A
       COMMENTS                     OWNER            LOG    LOC   S E L L E E P
----------------------------------------------------------------      S   N

42534 01005    E AUSTIN AVE                         00012
A G13 BRICK WALLS TO 16                             00008         1 1 2 1 7 0 6

42437 02782    S BLAIR AVE       FUNKHOUSER I       00015  00014
A 38C ORE TO 300 IN YARD         FUNKHOUSER I       00010     6   1 1 2 1 1 0 6

42420 00007    E BURTON AVE
A 20C                                                                     6 9 7

42418 00035    E BURTON AVE      NOLAN R            00012
A 18C                                               00008         1 3 1 2 7 9 5

42419 00062    E BURTON AVE
A 19C                                                                     6 9 7

42365 00405      CALIFORNIA ST
A 86A                                                                     6 9 5

42385 00488    N COLORADO ST     VALLONE J          00015  00019
A 19B UNEXPLAINED                VALLONE J          00011     6   1 1 2 1 1 0 6

42391 00610    N COLORADO ST     VAUGHT J           00016
A 25B BRICK TO 18                VAUGHT J           00009         1 3 1 1 7 0 6

42526 03357    S CRESTWOOD DR    SIMONSON JR        00015  00012
A G5 BRICK WALLS TO 19           SIMONSON JR        00009     1   1 1 2 1 1 0 6

42525 03431    S CRESTWOOD DR                       00015
A G4 ROCK RETAINING WALL TO 28                      00011         1 2 2 1 7 0 5

42426 00170      CRYSTAL AVE                        00016
A 26C UNEXPLAINED                UNKNOWN            00008         1 3 1 2 7 9 5

42513 02190      DELONG ST
A F30 DELONG 500 TO 850 SOUTH                                             6 9 5

42361 00733    W GENESEE         M J B CO           00016
A 82A BRICK TO 18                                   00012         5 2 1 1 7 0 5

42389 01400      GOODWIN AVE     NW JR HIGH         00013  00013
A 23B BRICK INSIDE TO 20         SALT LAKE C SCH DT 00007     9   7 2 1 1 1 0 6

42539 02420    S HIGHLAND DR     GENERATING PLANT   00014
A G19 BRICK WALLS TO 17          UTAH PWR+LIGHT CO  00010         5 1 3 1 7 0 5

42543 03007    S HIGHLAND DR     NATIONWIDE LOANS   00015  00012
A G23 BRICK WALLS TO 18          LANDES+SONS INC    00010     9   6 2 1 1 1 0 6

42530 03020    S HIGHLAND DR     VALLEY BANK+TRUST  00012  00012
A G9 BRICK WALLS TO 16           VALLEY BANK+TRUST  00008     9   5 2 1 1 1 0 6

42536 03092    S HIGHLAND DR     VILLA THEATRE      00012  00012
A G16 BRICK WALLS TO 16          NATIONAL GENERAL   00008     9   6 9   1 1 0 6

42368 01400    W INDIANA AVE     POPLAR GROVES DAY  00012
A 01B BRICK TO 18                                   00010         7 1 3 1 7 0 5
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## APPENDIX D (CONT)

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UTAH COMPREHENSIVE BY CITY, STREET ADD.          PAGE                  C   L   S
SALT LAKE CITY, UT                               01/09/73              L T E H C
                                                                       A Y V A R U M
LOC.NO.          ADDRESS           OCCUPANT              HOG    HIG    S P E T E S A
      COMMENTS                     OWNER                 LOG    LOC    S E L L E E P
------------------------------------------------------------------         S   N

42373  01527   W INDIANA AVE
A 7B                                                                           6 9 5

42343  00989     JEWELL AVE        AMERICAN STONE        00014  00011
A 50A ROCKS TO 27                  ASTON DR              00007    9    5 2 1 2 1 0 6

42429  02440   S MAIN ST           UNDERPASS I80         00016
A 29C UNEXPLAINED POSS GEOMETRY    CITY OF SALT LAKE     00010         9       1 0 6

42430  02500   S MAIN ST           BONWOOD BOWL          00013  00012
A 30C UNEXPLAINED                  WHITE W               00009    9    5 2 1 1 1 0 6

42433  02685   S MAIN ST           MAIN ST POULTRY       00014  00013
A 33C UNEXPLAINED                  NEALL M               00009    9    5 2 1 1 1 0 6

42432  02701   S MAIN ST           RITE WAY AUTO SALE
A 32C                              TAVISH F                            5       2 9 2

42404  02880   S MAIN ST           HEWLETT PACKARD       00011  00014
A 04C UNEXPLAINED                  CAPTOL INDUSTRIES     00009    9    5 2 2 1 1 0 6

42393  03336   S MAIN ST           THE SHADE SHOP        00300  00012
A 27B T NE + SW CRNRS OF BLDG      LAYCOCK J             00015    9    5 2 1 1 1 3 7

42394  03700   S MAIN ST           SLC FIRE DEPT         00400  00110
A 28B T ENTIRE AREA                COUNTY OF SALT LAK    00040    5    9 2 1 1 1 3 1

42428  00037   W MILLER ST
A 28C                                                                          6 9 5

42524  03650   E MILLSTREAM LN     MILL CREEK WARD 13    00015  00014
A G3 BRICK WALLS TO 20             LDS CHURCH            00012    9    8 2 2 1 1 0 6

42519  01435   E MURPHEY LN        JONES CL E            00015  00012
A F36 BRICK WALLS TO 18            JONES CL E            00010    6    1 1 3 1 1 0 6

42518  01445   E MURPHEY LN        WANSLEY LF            00010  00012
A F35 BRICK WALLS TO 18            WANSLEY LF            00008    6    1 1 2 1 1 0 6

42381  00122   S NAVAJO ST         SILVEX IND            00012  00014
A 15B BRICK TO 18                  AFCO IND PARK         00009    9    5 2 2 1 1 0 6

42380  00151   S NAVAJO ST         VACANT                00013
A 14B UNABLE TO CK BRK-2ND FLOR                          00008         5 2 2 1 7 9 5

42374  00200   S NAVAJO ST         HWY UNDERPASS         00017
A 8B HOG DUE TO GEOMETRY           CITY OF SALT LAKE     00011         9       1 0 6

42372  00327   S POST ST           VACANT AREA           00016
A 05B HOG DUE TO GEOMETRY                                00009         0       1 0 7

42531  03010   S RICHMOND ST       BASWELL V             00015  00014
A G10 BRICK WALLS TO 20            BASWELL V             00010    6    2 1 2 1 1 0 6

42445          S STATE ST          W OF 2319 S.STATE
A 46C                                                                          6 9 7
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APPENDIX D (CONT)

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UTAH COMPREHENSIVE BY CITY, STREET ADD.         PAGE                     C   L   S
SALT LAKE CITY, UT                              01/09/73                 L T E M C
                                                                         A Y V A R U M
LOC.NO.          ADDRESS              OCCUPANT            HOG     HIG    S P E T E S A
        COMMENTS                       OWNER              LOG     LOC    S E L L E E P
------------------------------------------------------------------------      S   N
----------------------------------------------------------------

42448  02225    S STATE ST          DOG + CAT HOSPITAL  00012   00011
A 2D BRICK TO 17                    DENKERS D           00009     9      5 2 1 1 1 0 6

42444  02319    S STATE ST                                                       6 9 7
A 45C

42446  02325    S STATE ST                                                       6 9 7
A 47C

42409  02400    S STATE ST          UNDERPASS HWY I-80  00012
A 9C POSS DUE TO GEOMETRY           CITY OF SALT LAKE   00009            9       1 0 6

42443  02481    S STATE ST          MADISON SCHOOL      00011
A 44C BRICK TO 22-ADDRESS GUESS     SLC SCHOOL DISTRCT  00008            7 1 3 1 7 0 6

42442  02547    S STATE ST          FIRESTONE TIRE      00012   00010
A 43C UNEXPLAINED                   LARSON R            00009     9      5 2 1 1 1 0 6

42422  02550    S STATE ST          THE ASSOCIATES FIN  00013   00012
A 22C UNEXPLAINED                   FAIRCLOUGH A        00009     9      6 2 1 1 1 0 6

42416  02561    S STATE ST          PRINTING            00013   00012
A 16C BRICK TO 17                   LARSON R            00008     9      6 2 1 1 1 0 6

42417  02567    S STATE ST          SANDERS WIN SHD CO  00012   00010
A 17C UNEXPLAINED                   SANDERS R           00009     9      6 2 1 1 1 0 6

42415  02615    S STATE ST          CHARELSWORTH        00012   00012
A 15C BRICK TO 17                   CHARELSWORTH        00010     9      6 2 2 1 1 0 6

42436  02700    S STATE ST          MASTERCRAFT UPHOLS  00016   00010
A 36C BRICK TO 18                   CALL WG             00009     9      5 2 1 1 1 0 6

42410  02740    S STATE ST          LEAVER DRUGS        00012   00013
A 10C BRK TO 17 CLOCKS TO 50        LEAVER SC           00007     9      5 2 1 1 1 0 6

42461  02795    S STATE ST          XL CLEANERS         00015   00013
A 15D UNEXPLAINED                   DIETZ J             00009     9      5 2 1 1 1 0 6

42405  02862    S STATE ST          JERMAN REALTORS     00015   00014
A 05C BRICK TO 17                   JERMAN OR INV CO    00010     9      5 1 3 1 1 0 6

42414  02935    S STATE ST          BOBS MOTEL          00016   00012
A 14C+17D UNEXPLAINED               TRIPP O             00009     9      4 1 3 1 1 0 6

42413  03007    S STATE ST          MILLSTREAM TRLR PK  00200
A 13C T NEXT TO ST N OF DRWY        KITCHENS G          00007            9 3 1 2 7 2 7

42411  03035    S STATE ST          HOLIDAY MOTEL       00014   00012
A 11C SHINE FR A 12C                MIYAZAKI            00008     9      4 2 1 2 1 0 6

42412  03040    S STATE ST          HOLIDAY INN         00200   00014
A 12C + 2C-T N + W OF BLDG          WRIDE               00011     9      4 2 2 1 1 3 7

42398  03319    S STATE ST          THE SPOT            00014   00013
A 32B UNEXPLAINED                   WILLIE C            00008     9      6 2 1 1 1 0 6
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UTAH COMPREHENSIVE BY CITY, STREET ADD.        PAGE                    C   L   S
SALT LAKE CITY, UT                              01/09/73                L T E M C
                                                                        A Y V A R U H
LOC.NO.        ADDRESS              OCCUPANT              HOG    HIG    S P E T E S A
        COMMENTS                    OWNER                 LOG    LOC    S E L L E E P
---------------------------------------------------------------------       S   N

42402  03419    S STATE ST          PEDERSEN INTERIORS    00010  00015
A 01C STUCCO TO 19                  PEDERSEN R            00006    9    5 2 1 1 1 0 6

42399  03566    S STATE ST          NIGHT LIFE            00013  00014
A 33B BRICK FRPLACE TO 20           CARROLE M             00008    9    5 2 1 1 1 0 6

42397  03620    S STATE ST          VALLEY BANK BUILD
A 31B                                                                   5       2 9 2

42400  03650    S STATE ST          DUCE SPORT GOODS      00013  00012
A 34B BRICK TO 19                   MALOUF G              00009    9    5 2 1 1 1 0 6

42401  03750    S STATE ST          ALBERTSONS            00012  00009
A 35B BRICK TO 17                   PAPONICHLOS           00006    9    6 2 1 1 1 0 6

42470  03897    S STATE ST          BOBS V CLUB
A 25D                               BRUNO J                             6       2 9 2

42424  00150    W STRATFORD AVE     RIDER PLASTICS        00016  00014
A 24C BRICK TO 17                   RIDER PLASTICS        00011    9    5 2 1 1 1 0 6

42425  00164    W STRATFORD AVE     VACANT LOT            00035
A 25C T SW CORN  LOT - SHINE 40     UNKNOWN               00012         0       1 2 7

42388  01186      TOPAZ DR          STATES L D            00014
A 22B UNEXPLAINED                   STATES L D            00009         1 2 1 1 7 9 5

42387  01304      VALENTINE ST
A 21B NO SUCH ADD                                                               6 9 7

42406  02465    S W TEMPLE          MARSH + SON           00015  00015
A 6C UNEXPLAINED                    MARSH RW              00008    7    5 2 1 1 1 0 6

42431  02511    S W TEMPLE          LE VOYS               00013  00014
A 31C BRICK TO 20                   SORENSON J            00009    9    5 2 2 1 1 0 6

42423  02550    S W TEMPLE          JUDKINS CO            00015  00013
A 23C BRICK TO 19                   JUDKINS R             00008    9    5 2 2 1 1 0 6

42407  02650    S W TEMPLE          HEUSSER BALANCES      00011  00011
A 07C UNEXPLAINED                   RUEFENACHT W          00007    9    5 2 1 1 1 0 6

42403  02975    S W TEMPLE          WORTHINGTON           00060  00009
A 03C T IN DR N OF BLDG BRK 18      PRICE J               00011    9    5 2 1 1 1 3 7

42427  03135    S W TEMPLE          DAY T                 00018  00016
A 27C HOG BUSHES S SD HSE           KINGSTON JB           00010    6    1 1 2 2 1 0 6

42538  01527    E ZENITH ST         RAY OA                00015  00014
A G18 ORE INSIDE + OUT TO 3000+     RAY OA                00010    6    1 1 2 1 1 0 6

42383  01000    W 100 N ST          STATE FAIR BLDG 11    00013
A 17B UNEXPLAINED                   STATE OF UTAH         00009         9 2 1 1 7 9 5

42384  01000    W 100 N ST          STAT FAIR COLISEUM    00014  00011
A 18B BRICK TO 21                   STATE OF UTAH         00008    9    9 2 1 1 1 0 6
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UTAH COMPREHENSIVE BY CITY, STREET ADD.      PAGE                         C   L   S
SALT LAKE CITY, UT                           01/09/73                     L T E M C
                                                                          A Y V A R U M
LOC.NO.       ADDRESS             OCCUPANT                HOG    MIG      S P E T E S A
         COMMENTS                  OWNER                  LOG    LOC      S E L L E E P
-------------------------------------------------------------------          S   N

42460  00702   E 100 S ST         HALF PRICE MARKET       00012  00010
A 14D BRICK TO 17                 TAFT W                  00009    9      5 2 1 1 1 0 6

42382  00930   W 100 S ST         METAL ART CO            00015  00012
A 16B UNEXPLAINED                 TELFORD RW              00009    9      6 2 1 1 1 0 6

42529  02742   S 1000 E ST        STORAGE + GARAGE        00014  00015
A G8 BRICK WALLS TO 17            BIESINGER FG            00010    9      5 2 2 1 1 0 6

42345  03341   S 1000 W ST        E OF 999 3300 ST        00020
A 52A+54A POSS WNDBLN T+SHNE 25   UNKNOWN                 00015           0       1 4 6

42533  03100   S 1100 E ST        INTERSTATE BRICK        00017  00014
A G12+14 CLAY+BRICK TO 25         MTN FUEL CO             00012    9      5 1 2 1 1 0 6

42532  03194   S 1100 E ST                                00016
A G11 STUCCO WALLS TO 20          UNKNOWN                 00012           2 3 2 1 7 0 5

42379  00175   S 1100 W ST        VACANT                  00013
A 13B BRK TO 17                                           00009           5 2 2 1 7 0 5

42367  00345   S 1335 W ST        LDS CHURCH              00011
A 88A BRICK TO 19                                         00009           8 2 1 1 7 0 5

42541  03175   S 1390 E ST        WILFORD WARD 1+2        00015
A G21 BRICK WALLS TO 22           LDS CHURCH              00011           8 1 3 1 7 0 5

42447          S 200 E ST
A 01D                                                                             6 9 5

42544  02750   S 2000 E ST        VACANT HOUSE            00014
A H1-NO 2730 ADD-BRICK WALL 20    UNKNOWN                 00010           1 3 1 1 7 0 5

42511  03130   S 2050 W ST        HILLS EE                00080  00014
A F1 T FR YD+S SIDE               HILLS EE                00010    9      1 3 1 1 1 3 7

42341  00850   W 2100 S ST        AMERICAN SERVICE        00015  00011
A 48A UNEXPLAINED                 LOWELL BM               00008    9      6 2 2 1 1 0 6

42342  00964   W 2100 S ST        LEAK M                  00015  00016
A 49A UNEXPLAINED                 LEAK M                  00009    0      1 2 1 1 1 0 6

42521  03695   S 2175 E ST
A E38                                                                     1 1 2 1 4 9 4

42421  00055   E 2400 S ST        HOWE RENTALS            00016  00013
A 21C UNEXPLAINED                 HOWE H                  00008    9      5 2 1 1 1 0 6

42540  01567   E 2585 S ST        SAVRITE A+G MARKET      00012  00012
A G20 BRICK WALLS TO 16           ALLRED HB               00008    9      5 2 1 1 1 0 6

42546  02980   S 2700 E ST        TAGGART NM B            00080  00016
A H3 T CARPORT SLAB ONLY          TAGGART NM B            00010    3      1 1 2 1 1 3 7

42522  03435   S 2700 E ST        VACANT                  00012
A G1 OLD FLOUR MILL SITE RCK 20                           00008           9       7 0 6
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UTAH COMPREHENSIVE BY CITY, STREET ADD.                       PAGE
SALT LAKE CITY, UT                                            01/09/73        C   L   S
                                                                              L T E M C
LOC.NO.        ADDRESS                                                        A Y V A R U M
                                      OCCUPANT                HOG    HIG      S P E T E S A
      COMMENTS                        OWNER                   LOG    LOC      S E L L E E P
---------------------------------------------------------------------------
                                                                                  S   N

42435  00014   E 2700 S ST
A 35C                                                                                 6 9 7

42463  00304   E 2700 S ST            LDS CHURCH              00014
A 18D + 37C BRICK TO 21               LDS CHURCH SLC          00008           8       7 0 6

42451  00501   E 2700 S ST            NIBLEY PARK MARKET      00015
A 05D BUS CLOSED UNEXPLAINED                                  00007           5 2 1 1 7 0 5

42441  00545   E 2700 S ST            EHLERT J                00013  00014
A 42C BRICK FIREPLACE TO 17           EHLERT J                00010      6    1 1 2 1 1 0 6

42440  00547   E 2700 S ST            BULLOCK                 00015  00014
A 41C BRICK TO 17                                             00009      6    1 1 2 1 1 0 6

42439  00555   E 2700 S ST            ARCHULETA M             00014
A 40C BRICK TO 18                                             00008           1 1 2 1 7 0 5

42438  00563   E 2700 S ST            FELLOWS WE              00014  00010
A 39C BRICK TO 18                     FELLOWS WE              00008      6    1 1 2 1 1 0 6

42464  00902   E 2700 S ST            NYGRENS MARKET          00015  00012
A 19D+17G BRICK TO 18                 NYGREN P                00010      9    5 1 2 1 1 0 6

42537  00902   E 2700 S ST            NYGRENS MARKET-DUP
A 19D+17G  DUPLICATE LOC  42464       NYGREN-DUP  42464

42434  00031   W 2700 S ST
A 34C                                                                                 6 9 7

42472  03687   S 2740 W ST            CARTER JA               00300  00050
A 2E T ENTIRE PROP                    PAIZ E                  00014      6    1 1 2 1 1 3 1

42471  03690   S 2740 W ST            ADAMSON NW
A 01E                                 ADAMSON NW                              1 2 2 1 4 9 4

42545  02206   E 2935 S ST            GARDEN HEIGHTS WRD      00012  00012
A H2 BRICK TO 18                      LDS CHURCH              00008      9    8 1 2 1 1 0 6

42449  02400   S 300 E ST             HWY I 80 UNDERPASS      00016
A 03D UNEXPLAINED                     CITY OF SALT LAKE       00010           9       1 0 6

42296  02545   S 300 W ST             VACANT LOT              01000
NO MOB-ADD GUESS-T ENTIRE LOT         US GOVT                 00100           0       1 2 7

42396  03365   S 300 W ST             BOYERS FOOD PROD        00300  00015
A 30B T PARKING  AREA                                         00008      9    5 2 1 1 1 3 7

42395  03451   S 300 W ST             YOUNGS TRUCK LINES      00012  00013
A 29B UNEXPLAINED                     ATCO INVESTMENT         00007      6    5 1 2 2 1 0 6

42462  00137   E 3185 S ST            VACANT HSE TRLR         00100
A 16D T UNDER S SEC OF TRLR HSE       UNKNOWN                 00012           1 3 1 2 7 3 7

42548  00047   E 3300 S ST            LDS CHURCH              00016  00015
A H5 BRICK WALLS TO 20                LDS CHURCH              00010      9    8 1 2 1 1 0 6
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UTAH COMPREHENSIVE BY CITY, STREET ADD.     PAGE                  C   L   S
SALT LAKE CITY, UT                          01/09/73              L T E M C
                                                                  A Y V A R U M
LOC.NO.        ADDRESS             OCCUPANT          HOG    HIG   S P E T E S A
       COMMENTS                     OWNER            LOG    LOC   S E L L E E P
----------------------------------------------------------------      S   N

42547  00067   E 3300 S ST       MILLERS HONEY      00015  00010
A H4 BRICK WALLS TO 18           MILLER D           00011    9    5 2 2 1 1 0 6

42552  00220   E 3300 S ST       AMOS RENTS         00012  00015
A H9 BRICK WALLS TO 18           TOWERS JM          00009    9    6 3 1 1 1 0 6

42553  00704   E 3300 S ST       SCOTT J            00015
A H10 BRICK TO 18-INSIDE REFUSE  SCOTT J            00010         1 1 2 1 7 0 4

42517  01103   E 3300 S ST       J+K MARKET         00014  00012
A F34 BRICK WALLS TO 17          KUMARELAS V        00009    9    6 1 2 1 1 0 6

42535  01105   E 3300 S ST       BARBARA JENSEN INT 00010  00012
A G15 BLOCK WALLS TO 15          BARBARA JENSEN INT 00008    9    5 2 1 1 1 0 6

42514  01444   E 3300 S ST       APOSHIAN ENGINEERS 00040  00012
A F31 T ASPHALT PARKING N SIDE   APOSHIAN GZ        00010    9    6 2 2 1 1 3 7

42542  01565   E 3300 S ST       POND C             00013
A G22 BRICK WALLS TO 22          POND C             00009         1       7 0 5

42515  02405   E 3300 S ST       IVINS LR           00014  00014
A F32 ORE FRNT YD BY STEPS 300   IVINS LR           00010    6    1 1 2 1 1 0 6

42516  03298   E 3300 S ST       DON QUIXOTE RESTRN 00012
A F33 BRICK WALLS TO 16                             00009         6 1 2 1 7 0 6

42295          W 3300 S ST       VITRO MILL AREA    3000+
NO MOB-DUNCAN REQUEST            SEVERAL            00020         9       1 3 1

42549  00010   W 3300 S ST       OLSONS SPORTS CAR  00011  00014
A H6 BRICK WALLS TO 16           ANDERSON EI        00008    9    5 2 1 1 1 0 6

42551  00155.5 W 3300 S ST       VACANT LOT         00040
A H8 T CENTER-NORTH SIDE         GREAT BASIN SUPPLY 00010         0       1 2 7

42408  00184   W 3300 S ST       KOHLER PLUMB SUPP  01000  00190
A 8C+H7-HIG IN DISPLAY AREA      ADAMS A            00020    8    5 2 1 1 1 3 1

42550  00184   W 3300 S ST       KOHLER PLUMB - DUP
A 8C+H7-DUPLICATE OF LOC 42408   ADAMS A-DUP 42408

42359  00315   W 3300 S ST       LOSSER R           00110  00013
A 73A T IN DRIVE E SIDE HSE      LOSSER R           00009    2    1 2 1 2 1 3 7

42360  00498   W 3300 S ST       VACANT LOT         00030
A 74A-POS WNDBLWN T/SHINE TO 30  UNKNOWN            00020         0       1 4 6

42358  00499   W 3300 S ST                          00030
A 72A T WND BLWN+SHINE TO 30                        00014         0       1 2 7

42308  00595   W 3300 S ST       WESTERN AUTO WRECK 00040  00019
A 12A+70A+71A WND BLWN/SHINE 45  PETERSON C D       00025    9    5 2 1 1 1 4 6

42357  00651   W 3300 S ST       KENNEDY K          00090  00018
A 68A T WND BLWN ENTIRE PROP     THUET J            00040    0    1 2 1 1 1 3 6
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UTAH COMPREHENSIVE BY CITY, STREET ADD.                  PAGE          C   L   S
SALT LAKE CITY, UT                                       01/09/73      L T E M C
                                                                       A Y V A R U M
LOC.NO.        ADDRESS             OCCUPANT              HOG    HIG    S P E T E S A
       COMMENTS                     OWNER                LOG    LOC    S E L L E E P
--------------------------------------------------------------             S   N

42356  00661   W 3300 S ST
A 67A                                                                  1       2 9 2

42355  00671   W 3300 S ST         BLUMENTHAL BROS       00090
A 66A T WND BLWN ENTIRE PROP                             00035         5 2 1 1 7 3 5

42307  00681   W 3300 S ST         VACANT HOUSE          00110
A 11A+65A T WNDBLWN ENTIRE YD      UNKNOWN               00040         1 1 2 1 7 3 5

42354  00825   W 3300 S ST                               00220
A 64A T S SD OF ROAD + WND BLWN                          00025         0       1 2 7

42353  00837   W 3300 S ST         MARTINEZ JG           00100
A 63A T WND BLWN/SHINE TO 110                            00060         1 3 1 1 7 4 5

42352  00845   W 3300 S ST         HANSON RL             00120  00040
A 62A T WNDBLN YARD-HIG SHINE      HANSON RL             00040    1    1 3 1 1 1 3 1

42351  00855   W 3300 S ST         WHITAKER EH           00080  00040
A 61A T ENTIRE YRD/SHINE TO 90     WHITAKER EH           00040    1    1 3 1 1 1 3 1

42350  00863   W 3300 S ST         BINGHAM RL            00070  00025
A 60A T WNDBLWN YD+SHINE TO 70     BRADSHAW GL           00025    0    1 3 1 1 1 3 1

42349  00871   W 3300 S ST         LAVADIE M             00060  00018
A 59A T WND BLWN ENTIRE PROP       LAVADIE M             00040    9    1 3 1 1 1 3 6

42323  00881   W 3300 S ST         UNKNOWN               00065
A 29A+58A WNDBLWN T+SHINE TO 65                          00030         1 3 1 1 7 4 5

42348  00925   W 3300 S ST         FREDRICKSON E         00050
A 57A+A56 WND BLWN/SHINE TO 55                           00020         1 2 1 1 7 4 5

42347  00949   W 3300 S ST         CRACROFT JW           00030  00013
A 55A T WND BLWN SHINE TO 40       CRACROFT JW           00017    6    1 1 2 1 1 3 6

42346  00999   W 3300 S ST         ARMONDS LOUNGE        00019  00012
A 53A SHINE TO 20                  PERRY A               00012    9    5 2 1 1 1 0 6

42344  01021   W 3300 S ST         E OF 1061 3300 S      00030
A 51A T WND BLWN/SHINE TO 45                             00020         0       1 4 6

42473  02000   W 3500 S ST         MURRAY 1ST THRIFT     00050  00014
A 03E T UNDER SW CRNR              MURRAY 1ST THRIFT     00010    9    5 2 1 2 1 1 7

42512  05975   W 3500 S ST         WHITTIER ELE SCHL     00015  00014
A F2 BRICK WALLS TO 18             GRANITE SCHL DIST     00010    6    7 1 3 1 1 0 6

42475  03895   S 3520 W ST                               00016
A 05E BRICK TO 20                  UNKNOWN               00009         1 2 1 1 7 0 6

42309  00560   W 3740 S ST         SANCHEZ FD            00030
A 13A T E SIDE OF DRIVE                                  00010         1 3 1 1 7 2 7

42523          E 3800 S ST         UNDERPASS I-215       00015
A G2 HOG GEOMETRY OF CONCRETE      CITY OF SALT LAKE     00008         9       1 0 6
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## APPENDIX D (CONT)

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UTAH COMPREHENSIVE BY CITY, STREET ADD.        PAGE                   C   L   S
SALT LAKE CITY, UT                              01/09/73               L T E M C
                                                                       A Y V A R U
LOC.NO.         ADDRESS              OCCUPANT             HOG    HIG   S P E T E S
       COMMENTS                      OWNER                LOG    LOC   S E L L E E
-------------------------------------------------------------------        S   N

42520           E 3900 S ST        I-15 UNDERPASS       00016
A F37 HOG GEOMETRY OF CONCRETE     CITY OF SALT LAKE    00012          9         1 0

42392  00100    E 3900 S ST
A 26B UNABLE TO LOCATE                                                 0         6 9

42554  00922    S 400 E ST                              00015
A H11 ROCKS IN FR YD TO 400        UNKNOWN              00007          1 3 1 2 7 0

42386  00740    W 400 N ST         28TH WARD CHAPEL     00012
A 20B BRICK TO 22                                       00009          8 2 2 1 7 0

42377  00699    W 400 S ST         KETCHUM HARDWARE     00011  00011
A 11B BRICK PILE TO 18             KETCHUM CH           00009    9     5 2 1 1 1 0

42370  01036    W 400 S ST
A 03B                                                                            6 9

42371  01040    W 400 S ST                              00011
A 04B BRICK TO 21 ADD GUSS                              00009          8 2 1 1 7 0

42474           W 4000 S           W OF 3266 WEST
A 04E                              UNKNOWN                                       6 9

42450  02400    S 500 E ST         HWY I 80 UNDERPASS   00013
A 04D UNEXPLAINED                  CITY OF SALT LAKE    00009          9         1 0

42314  03443    S 500 W ST         CENTRAL LANDSCAPE    00017  00013
A 19A UNEXPLAINED                  FRENHER MC           00009    9     5 2 1 2 1 0

42313  03499    S 500 W ST         LAMPER JL            00019
A 17A•18A HOG SHINE                LAMPER JL            00011          1 3 1 2 7 0

42312  03513    S 500 W ST         BARKER J             00016  00013
A 16A SHINE FR A 15A TO 25         BARKER               00010    0     1 2 1 2 1 0

42311  03585    S 500 W ST         A•R MEATS            00100  00060
A 15A T FLOOR SLAB • YARD          A•R MEATS            00025    9     5 2 1 1 1 3

42310  03595    S 500 W ST         S OF 3585 S 500 W    00016
A 14A HOG IN SWAMP ADD GUESS       UNKNOWN              00007          0         1 0

42376  00412    S 600 W ST
A 10B NO SUCH ADD                                                                6 9

42452  00342    S 700 E ST                              00015
A 6D UNEXPLAINED                                        00009          3 1 2 1 7 9

42453  00350    S 700 E ST         STEVENS MENAGER C    00015  00015
A 07D UNEXPLAINED                  STEVENS J            00009    6     7 1 3 1 1 0 6

42454  00440    S 700 E ST         MID CITY PRO BLDG    00013  00012
A 08D UNEXPLAINED                  CHRISTENSEN          00007    6     6 1 3 1 1 0 6

42459  00915    S 700 E ST                              00014
A 13D UNEXPLAINED                                       00009          1 1 3 1 7 9 5
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UTAH COMPREHENSIVE BY CITY, STREET ADD.       PAGE                   C   L   S
SALT LAKE CITY, UT                            01/09/73               L T E M C
                                                                     A Y V A R U M
LOC.NO.      ADDRESS                    OCCUPANT          HOG   HIG   S P E T E S A
    COMMENTS                             OWNER            LOG   LOC   S E L L E E P
==========================================================================   S   N

42458  01399   S 700 E ST      WHITE ADVERTISING      00015  00012
A 12D BRICK TO 23                                      00008    6     6 1 3 1 1 0 6

42455  01632   S 700 E ST      HAWTHORNE SCHOOL       00012
A 09D BRICK TO 19              SLC SCH DIST           00009           7 1 3 1 7 0 6

42456  02226   S 700 E ST      CONTINENTAL BEAUTY     00015  00120
A 10D T UNDER W END OF SHOP    LUND H                 00008    7      7 1 2 1 1 1 1

42457  02400   S 700 E ST      HWY I 80 UNDERPASS     00016
A 11D UNEXPLAINED-POSS GEOMETRY CITY OF SALT LAKE     00010           9       1 0 6

42527  03225   S 700 E ST      LDS GRANT 2ND WARD     00014  00014
A G6 BRICK TO 18               LDS CHURCH             00011    9      8 1 3 1 1 0 6

42390  00755   W 700 N ST      LDS CHURCH 3 WARD      00011
A 24B BRICK TO 19                                     00009           8 2 2 1 7 0 6

42364  00939   S 700 W ST      PACIFIC METALS         00012  00011
A 85A BRICK TO 17              CASTLE                 00009    9      5 2 1 1 1 0 6

42363  01101   S 700 W ST      KOLDAIRE               00050  00150
A 84A T ENTIRE SLAB + PARKING  WHILHITE J             00009    9      5 2 1 1 1 3 1

42362  01201   S 700 W ST      MACHINERY CENTER       00014  00012
A 83A ORE IN EQUIP WASH 350    PIERCE ESTATE          00008    9      5 2 1 1 1 0 6

42306  03319   S 700 W ST      TURNER J               00090
A 10A T WND BLWN ENTIRE PROP                          00035           1 3 1 1 7 3 5

42305  03327   S 700 W ST      GAYOILLE CF            00110
A 09A T WND BLWN ENTIRE PROP                          00025           1 3 1 2 7 3 5

42304  03341   S 700 W ST      SOMMERS T              00050  00018
A 08A T WND BLWN ENTIRE PROP   SOMMERS T              00017    9      1 3 1 1 1 3 6

42303  03349   S 700 W ST      VACANT LOT             00050
A 7A+69A WNDBLWN T ENTIRE PROP SOMMERS T              00017           0       1 2 6

42297  03354   S 700 W ST      VACANT LOT             00130
A 1A WNDBLWN T ENTR LOT-ADD GUS AMERICAN SMELTING     00080           0       1 4 7

42302  03363   S 700 W ST      ENSIGN SHOE CO         00110  00012
A 6A WNDBLWN T YD+TRACK IN SHOP ENSIGN SHOE CO        00025    9      5 2 1 1 1 3 7

42298  03364   S 700 W ST      VACANT LAND            00090
A 2A WINDBLOWN T + SHINE TO 90 AMERICAN SMELTING      00030           0       1 4 7

42301  03389   S 700 W ST      FIRE ENGINEERING       00035  00010
A 5A WNDBLWN T SM AREA BK BLDG GILLETT H              00013    9      5 2 2 1 1 3 7

42300  03415   S 700 W ST      WELDERS SUPPLY         00018  00012
A 04A S SD YRD POSS ORE HOG    POLLOCK H              00009    9      5 2 1 2 1 0 6

42299  03422   S 700 W ST      AMER SMELT + REFIN     00020  00018
A 03A HIG DUE TO BRICK HOG SHIN AMER SMELT + REFIN    00012    9      5 2 1 1 1 0 7
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UTAH COMPREHENSIVE BY CITY• STREET ADD•        PAGE                 C   L   S
SALT LAKE CITY• UT                             01/09/73             L T E M C
                                                                    A Y V A P U M
LOC•NO•      ADDRESS                OCCUPANT               HOG    HIG   S P E T E S A
        COMMENTS                    OWNER                  LOG    LOC   S E L L E E P
----------------------------------------------------------------            S   N

42528  02533   S 800 E ST           BRUNSWICK JL           00500  00130
A G7 T LAWN•FLOWER BD•UTIL RM       BRUNSWICK JL           00014    9   2 2 1 1 1 3 1

42366  00615   W 800 S ST           PORTLAND CEMENT CO     00010  00011
A 87A UNEXPLAINED                   PORTLAND CEM CO UT     00007    9   5 2 2 1 1 0 6

42476  01397   W 800 S ST           EDISON SCHOOL          00013
A 6B ABANDONED SCH-BRICK TO 19                             00008        7 2 2 1 7 0 5

42468  01093   S 900 E ST           WOOLF LK               00012  00014
A 23D BRICK TO 18                   HAMMOND H              00009    6   2 1 2 1 1 0 6

42467  01307   S 900 E ST           ECONOMY ELECTRIC       00013  00011
A 22D BRICK TO 17                   GADISON INV            00009    9   6 2 1 1 1 0 5

42466  02179   S 900 E ST           GRANITE WELDING        00014  00010
A 21D UNEXPLAINED                   RALEIGH R              00008    9   6 1 2 1 1 0 6

42465  02400   S 900 E ST           HWY I 80 UNDERPASS     00013
A 20D UNEXPLAINED                   CITY OF SALT LAKE      00009        9       1 0 6

42469  03230   S 900 E ST                                  00013
A 24D VAC BUS BRK TO 22                                    00009        5 2 1 1 7 0 6

42324          S 900 W ST           OLD TAILING POND 1     3000•
A 30A•37A OLD TAILINGS PILE         VITRO CORP             02500        9       1 2 7

42331          S 900 W ST           OLD TAILING POND 2     02000
A 38A OLD TAILINGS POND 2           VITRO CORP             01700        9       1 2 7

42332          S 900 W ST           N OF TAIL POND 2       00120
A 39A WINDBLOWN TAILINGS•SHINE      UNKNOWN                00012        0       1 2 7

42336          S 900 W ST           S OF GRD CNTL WHSE     00090
A 43A WND BLWN/SHINE TO 110         UNKNOWN                00080        0       1 4 7

42337          S 900 W ST           MILL CREEK SOUTH       00110
A 44A WND BLWN /SHINE TO 160        UNKNOWN                00060        0       1 4 7

42338          S 900 W ST           SML CRK N TO MILL      00300
A 45A WND BLWN/SHINE TO 400         UNKNOWN                00090        0       1 4 7

42339          S 900 W ST           260 FT S OF SML CK     00400
A 46A HOG SHINE•POSS WINDBLWN T     UNKNOWN                00200        0       1 4 7

42340          S 900 W ST           W T PILE 3300 S ST     00200
A 47A WND BLWN/SHINE TO 300         VAC LAND UNKNOWN       00090        0       1 4 7

42378  00201   S 900 W ST           HWY I 80 UNDERPASS     00015
A 12B UNEXPLAINED-POSS GEOMETRY     CITY OF SALT LAKE      00011        9       1 0 6

42375  00402   S 900 W ST           VACANT                 00014
A 09B ROCK TO 20                                           00009        5 2 2 1 7 0 5

42369  00484   S 900 W ST           BOB • JOES MARKET      00012
A 02B BRK TO 17 BUS CLOSED                                 00009        5 2 1 1 7 0 5
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UTAH COMPREHENSIVE BY CITY, STREET ADD.     PAGE                 C   L   S
SALT LAKE CITY, UT                          01/09/73             L T E H C
                                                                 A Y V A P U M
LOC.NO.        ADDRESS            OCCUPANT          HOG    HIG   S P E T E S A
       COMMENTS                    OWNER            LOG    LOC   S E L L E E P
---------------------------------------------------------------      S   N

42333  02550   S 900 W ST       NATIONAL AD CO      00015  00013
A 40A UNEXPLAINED               SCIENCE SECURITY    00009    9   5 2 1 1 1 0 6

42334  02560   S 900 W ST       BROWN DIST CO
A 41A                           BROWN KC                         5     1 2 9 2

42335  02850   S 900 W ST       GRAN CENTRAL WAREH  00060  00012
A 42A T S SD OF PARKING LOT     PRICE J             00012    9   5 2 1 1 1 2 7

42330  03195   S 900 W ST       WON DOOR CORP       02500  00500
A 36A T ENTIRE PROP-SHINE 1200  WON DOOR CORP       00110    7   5 2 2 1 1 3 1

42329  03215   S 900 W ST       WONDOOR CORP        00550  00350
A 35A T ENTIRE PROP SHINE 550   WONDOOR CORP        00100    9   5 2 1 1 1 3 1

42328  03237   S 900 W ST       INVENTORY SALES     00400  00090
A 34A T WINDBLWN/SHINE HOG      CROMAR G            00090    9   6 2 1 1 1 4 1

42327  03265   S 900 W ST       VACANT LOT          00300
A 33A T ENTIRE LOT-HOG SHINE    UNKNOWN             00120        0       1 4 7

42326  03275   S 900 W ST       SIERRA CORP         00300  00065
A 32A T POSS WNDBLWN/SHINE HOG  BARRET B            00120    9   5 2 1 1 1 4 1

42325  03285   S 900 W ST       N OF 3300 S ST      00250
A 31A POSS WINDBLOWN T + SHINE  UNKNOWN             00090        0       1 4 7

42315  03302   S 900 W ST       KAY T               00050
A 20A T WND BLWN ENTIRE YRD     UNKNOWN             00020        1 2 2 1 7 3 5

42322  03331   S 900 W ST       NIELSEN WI          00040  00019
A 28A T WND BLN /SHINE TO 40    NIELSEN WI          00012    0   1 2 1 2 1 4 6

42321  03339   S 900 W ST       CORNELL S           00030  00060
A 27A TU SLAB FLOOR+SHINE TO 30 CORNELL S           00012    1   1 2 1 2 1 3 1

42316  03340   S 900 W ST       YATES R             00035
A 21A T WND BLWN ENTIRE YRD     UNKNOWN             00020        1 3 1 1 7 3 5

42317  03342   S 900 W ST       BROWN L             00030
A 22A WINDBLOWN T ENTIRE PROP   UNKNOWN             00020        1 1 2 2 7 3 5

42318  03364   S 900 W ST       COOK DL             00025  00013
A 23A+24A T WND BLWN ENTIRE YRD HUDSON S            00017    6   1 1 2 2 1 3 6

42320  03347   S 900 W ST       JOHNSON WE          00027  00019
A 26A T WND BLN/ SHINE TO 27    JOHNSON WE          00017    0   1 2 1 2 1 4 6

42319  03432   S 900 W ST       NORMAN N            00250  00011
A 25A N OF HSE IN JUNK YRD DRWY NORMAN N            00014    0   1 2 1 1 1 2 7
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# APPENDIX E

## U.S. Environmental Protection Agency's Informal Guidance for Assessment of the Need for Remedial Action Based on the Follow-up Gamma Survey Reports for Communities which are Located Near Uranium Mills

We recommend that tailings be removed if at all feasible and properly disposed of in a properly designated location, such as a tailings pile or on land provided for this purpose. Alternatives, such as ventilation and the use of sealants, may also be utilized. Consideration should be given to any potential adverse health impact of residual radiation level, the cost of reducing the residual radiation level, and the economic effect of these protective measures. Recommendations of actions to be taken in the assessment of anomalies are as follows:

1. Experience has shown that if tailings are located more than 10 feet from an occupied structure, the uranium tailings will not produce elevated radon levels inside the structure. They should still be removed when it is convenient and at a minimal cost to the individual.

2. Ore or other radioactive sources should be properly disposed of if they have no specific value to the owners.

3. "External gamma level" is defined as the net corrected average ground floor gamma (AGFG) value for the occupied portion of the structure.

4. If external gamma levels inside a structure are equal to or greater than 20 μR/h above background, the indoor radon concentration level may be presumed to equal or exceed 0.01 WL above background. If this condition exists, consideration should be given to further assessment to determine possible need of remedial action.

5. If external gamma levels inside a structure are less than 1 μR/h above background, it should be presumed that the indoor radon daughter exposures would be below 0.01 WL above background and no further assessment is required.

6. If external gamma levels inside a structure are equal to or greater than 1 μR/h above background but less than 20 μR/h above background, measurements should be made to determine the indoor radon daughter level, the location of tailings, and the need for and type of appropriate remedial action to be taken if warranted.

7. If tailings are found outside a structure, the cleanup and removal of material should result in levels as close to background as possible. In any event, the readings, after cleanup, should not exceed 50 μR/h above background.

Legislation exists which authorizes a Federal contribution to a joint Federal/State remedial action program in the area of Grand Junction, Colorado. However, there is no legislative authority to provide funds for support of a remedial action program in other areas.

# APPENDIX F

## U.S. Environmental Protection Agency's Recommendation for the Vitro Tailings Pile in Salt Lake City, Utah (June 7, 1973)

Studies at various uranium mill tailings pile sites have shown that the radon emanation from the tailings pile does not present a significant radiation exposure to the surrounding community outside a radius of one-half mile from the site. Workers on, or visitors to, the surface of the pile or adjacent to it would receive external gamma radiation exposure. The radon concentrations present on the Vitro pile exceed the current limits for population exposure; however, the short half-life progeny of radon are not in equilibrium with the parent radon. Thus, the observed working level (WL) exposures in the air at the sites sampled is low, but significant working level exposures can occur in a structure built over or adjacent to the tailings material.

EPA does not recommend approval of the "race track" proposal for the property known as the Vitro uranium mill tailings pile for the following reasons:

1. At the present time, the State of Utah has no regulations covering the use, non-use, stabilization, or otherwise effecting the disposition or control of radioactive mill tailings.

2. The current legal mechanisms by which the State of Utah may place restrictions on the property title or to control the use of this property and structures built on it are not specifically intended to cover such complex phenomena as ionizing radiation. This is of concern because of the possibility of future uses other than those originally approved which could result in unnecessary radiation exposure to workers or visitors at the tailings pile site.

3. Persons working at or attending given racing events would receive an unnecessary increment of radiation exposure. This unnecessary exposure, however low, would also be received unknowingly. According to a recent report of the National Academy of Sciences, "No exposure to ionizing radiation should be permitted without the expectation of a commensurate benefit."

Because studies have shown that an unstabilized and uncontrolled uranium mill tailings pile can create potential public health problems, EPA recommends that:

1. The State of Utah establish the necessary regulations to effect the disposition and control of radioactive mill tailings. These should not rule out the possibility of some acceptable use for any given closed mill site.

2. The Vitro uranium mill tailings pile should be properly stabilized to prevent migration of the tailings into the environment and prevent public ingress to the area. The pile should be graded, covered, properly fenced, and controlled to prevent any migration of the tailings into the surrounding environs by wind or water erosion, or removal of tailings for unauthorized purposes.

3. The State of Utah consider possible remedial actions for the businesses located on the west side of the Vitro uranium mill tailings pile along South 900 West.

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1. Augustine, R. J., Inventory of Active Uranium Mills and Tailings Piles at Former Uranium Mills, U.S. Department of Health, Education, and Welfare, U.S. Public Health Service, August 1970.

2. Evaluation of Radon-222 Near Uranium Tailings Piles, U.S. Department of Health, Education, and Welfare, U.S. Public Health Service, DER 69-1, March 1969.

3. Schiager, Keith J., The Evaluation of Radon Progeny Exposures in Buildings: A Report on Equipment and Techniques, Colorado State University, Department of Radiology and Radiation Biology, Fort Collins, Colorado, March 15, 1971.

4. Thomas, Jess W., "Modification of the Tsivoglou Method for Radon Daughters in Air," Health Physics, 19:691, November 1970.

5. 10 CFR Part 20, U.S. Atomic Energy Commission, Standards for Protection Against Radiation.

6. 10 CFR Part 12, U.S. Atomic Energy Commission, Grand Junction Remedial Action Criteria, September 28, 1972.

7. Tanner, Allan B., "Radon Migration in the Ground: A Review," The Natural Radiation Environment, University of Chicago Press, Chicago, Illinois, 1964, pp. 161-190.

8. Beck, Clifford K., Director, Office of Government Liaison Regulation, U.S. Atomic Energy Commission, Letter to Dr. W. D. Rowe, Deputy Assistant Administrator for Radiation Programs, U.S. Environmental Protection Agency, October 25, 1972.